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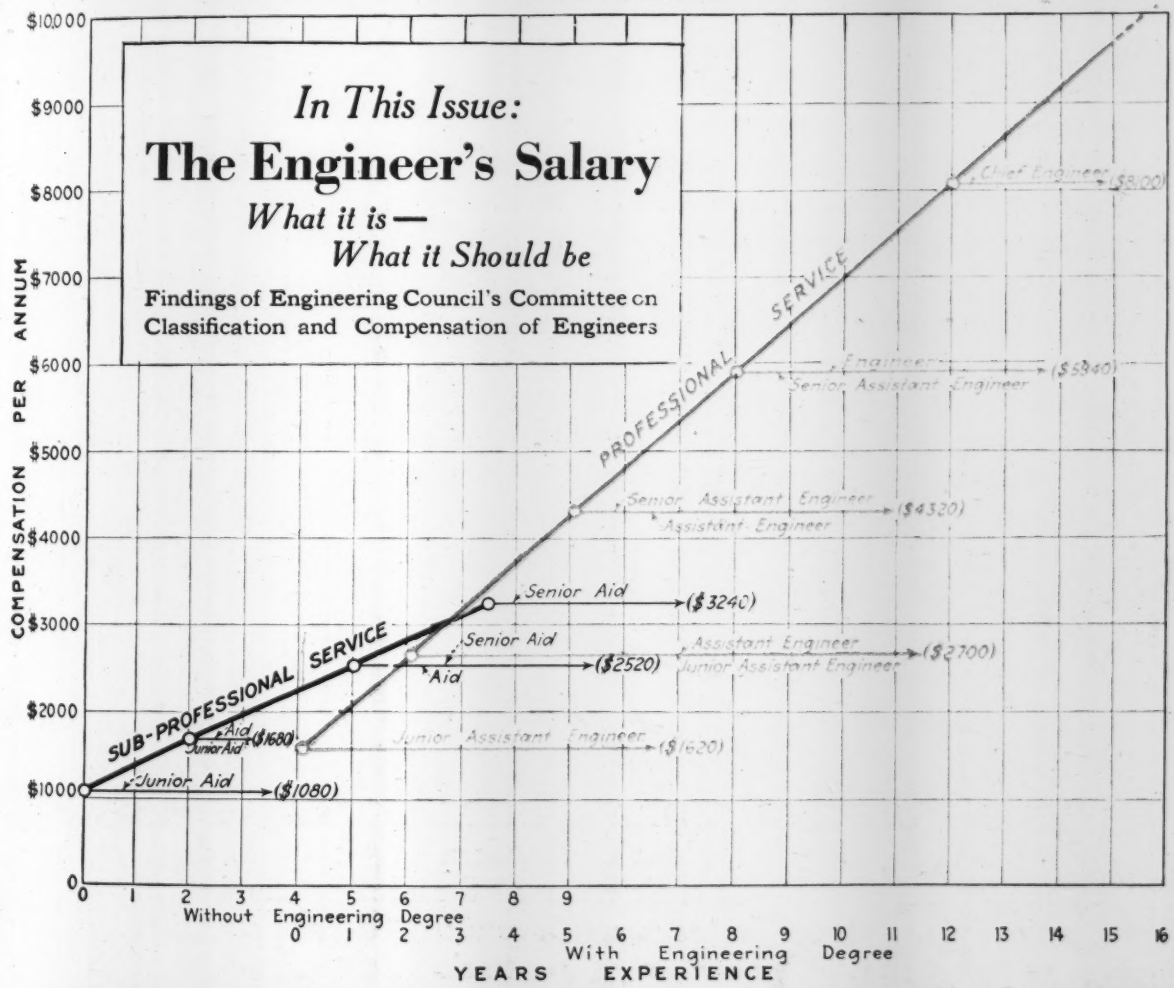

PROPOSED MAXIMUM RATE FOR INCREASING COMPENSATION THROUGH VARIOUS GRADES

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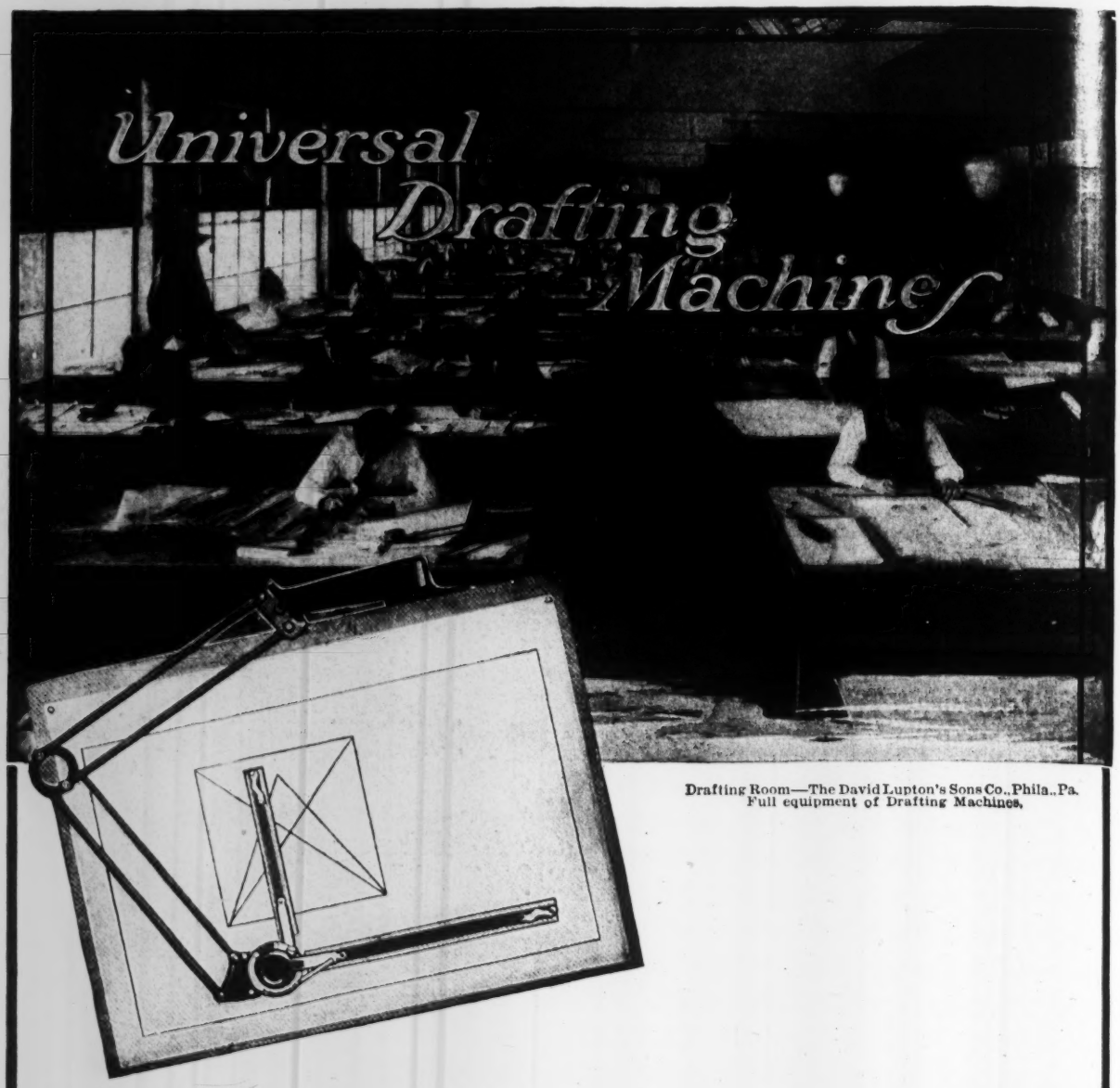
THEODORE HORTON
JOHN W. ALVORD
METCALF & EDDY
J. W. EVANS
W. H. DITTOE

Rental Values for Construction Plant

By F. J. HERLIHY



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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN
Editor

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What Will the Society Do About It?

NEXT week the American Society of Civil Engineers will consider at its annual meeting the report of the Committee on Development. What will the society do about it?

A year and a half ago, sensing the need of an appraisal of the society's activities, the board of direction appointed the committee. The latter has diligently sought the suggestions of members, has in two protracted meetings discussed the proposals, and has laid its conclusions before the members in a series of recommendations. The committee's work being done, the responsibility for action rests with the members.

Consideration of important questions in annual meetings has not always been satisfactory. The curt dismissal of the report on the amendment of the constitution some years ago is a case in point. Perfunctory handling of the present report is not to be expected, but nevertheless there is danger, because of the preponderance of members from one section, of a failure to present a true picture of the attitude of the membership. The attendance being largely Eastern, is also likely to be conservative. At the same time most of those present have no contact with members in outlying districts, and, even with the best of intentions, find it difficult to get the point of view of those living, let us say, west of Philadelphia and south of Washington.

If the attitude of those outside Districts 1, 2 and 3 is correctly presented, we believe that there will be heard a very general and strong approval of the committee's report. We have had direct word from twelve cities where there are local associations of members, and, without exception, the sentiment is summarized as favorable to the report. There are qualifications, of course, but there is a strong conviction that we have here a basis for desirable changes.

This attitude is all the more significant because the early reception of the report appeared to be an indifferent one. The document has won support in the degree it has been studied. This was to be expected from the very form of the report. The individual had to do his own appraising of the relative importance of the recommendations, and had himself to furnish the supporting reasons. These processes took time, but the resultant approval is all the more reason for expecting insistence upon the carrying out of the recommendations.

Unless the situation is anticipated, an obvious weakness of the report is likely to have an important effect at the meeting; the report proposes no practicable method by which the membership may express its views. General discussion will have the effect of clarification, but it is too much to expect that a letter ballot will be invited on the document as it stands. It spreads over too wide a field to ask for a blanket approval. Obviously separate ballot must be taken on the Joint Conference plan. The internal recommendations must be split into groups and as to each a question or two formulated that will be determinative of policy. Questions of that sort were formulated, we understand, and transmitted to the board of direction with the report, but those or similar questions will have to be put before the society next Wednesday, if discussion is not to "wander all over the lot" and be barren of results. Either the board must take the initiative of propounding such questions, or members of the committee on development must do so. The committee has been discharged, but its members individually must feel a responsibility until the report is disposed of.

We hope, therefore, that a clear, searching set of questions, relatively few in number, will be proposed at the outset of the discussion next Wednesday and that the outlying districts will be represented by those who know the views of their fellow members and have the ability to present them clearly and vigorously.

Only in this way can we expect action that will be purposeful and representative.

Joint Conference Committee Report

IT IS indicative of the present tendency of engineers' thinking that fully as much, if not more, interest is displayed in the report of the Joint Conference Committee as in that on the internal affairs of the society. The plan proposed may not be perfect. The funds asked are admittedly inadequate. But despite the deficiencies, we believe that the plan should be adopted.

The weightiest objection is that if local bodies came in in large numbers the representation of the founder societies in the national council and the executive committee would be disproportionately small. This objection is not, in our judgment, a very serious one. If there were likelihood of the local and state affiliations electing representatives who were out of sympathy with the founder societies there might be some cause for alarm. As a matter of fact, we all know that the leaders in the local bodies are, with rare exceptions, members of the nationals. They are at heart founder-society men.

There are other minor objections, but despite them we believe that the scheme should be put into effect. It can be amended later. It is now or never. If this plan be rejected, it will be a long day before any other federated plan will be taken up with enthusiasm.

In approving the plan there is possibility, in fact advisability, of reasonable qualifications. We should propose one of them ourselves, namely, that it be stipulated that a large part of the effort and funds of the body be expended on measures aimed to help the local organizations help themselves. This disposition would come about, to some extent, by the mere participation of the locals in the activities of the new body, but assurance should be offered the locals in advance that such is the intent and purpose of the federation.

Internal Changes

WITH reference to the internal changes suggested in the report there are some that can be passed over without discussion because, we believe, they will have general endorsement. Two which can be placed in that category are the recommendation involving the increase in technical activities and that which provides for nomination and election of directors by the districts. Obviously all of the recommendations regarding the increase in technical activities cannot be carried out until funds are made available, and when those funds do become available it will be proper to inquire as to the relative value of committee work and of the publication of papers. With reference to district nomination and election of directors, the legal aspects, under the New York State charter, must be looked into.

Some of the other internal recommendations cannot be passed over too lightly. The policy with reference to local sections, in particular, needs very thorough discussion. Undoubtedly it is desirable to build them up, but the scheme that provides that every member of the society shall be affiliated with a section seems primarily one to get funds from the national body. The committee's plan would result either in erecting a great many small sections, which because of their smallness would be incapable of doing worth-while work, or headquarters would be contributing to local sections for members living in the highways and byways, who could not attend section meetings and who would get no return for the moneys that the national organization would appropriate on their behalf to local section maintenance. These members could serve on the sectional special committees, but that alone would not seem to be adequate recompense for the per capita appropriation to the local body.

If the rebating of certain portions of the dues would apply only to those living within the confines of, or reasonable distance of, the section city, there could be little objection to the rebating.

Annual conferences of local sections are desirable, but to vest them with the power of a nominating committee would be possible only if the committee recommendation of putting every member in a section were carried out.

The proposed revision of membership requirements which would make it necessary to hold associate membership for two years before becoming a "member" is not desirable. Cases will always occur where applicants with qualifications for full member present themselves, and an ironclad rule obliging such a man to enter in a grade beneath his qualifications would have a tendency to keep some of these mature and desirable engineers out of the organization.

The committee suggests that dues "be adjusted." This can have no other meaning than that the dues should be increased. The society, like the individual, is suffering from the high cost of living, while demands for broadened activities are insistent.

In increasing dues an obvious procedure would be to raise those of "non-resident" members to equal the dues of "resident" members. It is high time to abolish the resident and non-resident distinction. The argument that the "resident" member has the advantage, being near headquarters, of attending meetings and using the library, has support in imagination rather than in fact. The library is an advantage for the *very, very few* who use it, but the meetings are of no more value than those of any local section. District [illegible] should be placed on exactly the same basis as oth[illegible] districts, so far as dues are concerned. A New Yor[illegible] local section is badly needed, and when established ca[illegible] readily take care of meetings for the local members.

The various recommendations as sketched cover, a[illegible] we see them, the essential points in the committee's report. The question to which most objection can be raised is, in our judgment, that of forcing every member into a local section. If it can be shown that every member of the society would draw benefit from it, the proposal is defensible. Otherwise it would be unthinkable, unless the members of the society by an overwhelming majority should indicate their desire of contributing to the support of the locals by giving them funds for which the corresponding members are not expected to get a return. It is entirely possible that the membership will consider the upbuilding of local sections so important that they would authorize such appropriation of funds, but its inequity could not be overcome save by devising some form of service for these men or justifying it on the basis of the larger returns that would accrue to all from the heightening of the general society activities.

As we see the work of the development committee, therefore, we believe that it should receive the approval of the society. We believe that the chief items should be submitted to letter ballot, so that the opinions of the members upon the proposed changes may be recorded. If the questions fairly embody the substance of the chief recommendations of the committee, and if the membership at large will study the questions thoroughly, we believe that the recommendations, saving those on membership requirements and the sectionalizing of the whole society, will get general support.

Symposium on Municipal Risks

OPINIONS by eight engineers on what risks cities should take with apparatus or processes in the experimental or development stage are printed on p. 132. Briefly, the concensus of opinion is that while some risk must be taken if progress is to be made, yet cities should not adopt undemonstrated processes or apparatus without assurance from competent disinterested engineers that the plant to be installed will do the required work, and do it as well and as cheaply as it can be done by well tried processes.

Risks by Big and Little Cities

ONE contributor in the symposium mentioned above rightly holds that a big city can afford heavier financial risks than can a small one. A large city, too, can afford to build a working-scale unit and test it under the direction of a staff of specialists—a thing rarely feasible for a small city. Moreover, the larger the city that adopts a less costly process than those already in use the greater the economic gain, even though the reaction upon the city tax rate or the utility service charge may be the same in either case. But it is also true that the larger the city that makes an unsuccessful venture in a new field the greater will be the economic loss to society.

Proper Attitude for State Boards

WHAT attitude should state health authorities take when passing on plans for innovations in water or sewage treatment that may do the required work but

probably at far higher cost than it could be done by some well-tried method? A strong inclination to approve such doubtful plans is shown by one correspondent but this seems to be based largely on doubt as to the legality of disapproval if based on other than sanitary grounds. The argument of the context, however, needs to be carried only a little further to show, especially if illustrated by such experiences as those cited in the following paragraph, that when a city finds itself with an unnecessarily expensive plant it is likely to neglect upkeep, skimp on operation expense and perhaps shut down the plant.

Further Lessons from Oklahoma

ABANDONED electrolytic sewage-treatment plants in the State of Oklahoma, it appears from the report on p. 135 number six instead of the two mentioned in our issue of Nov. 27-Dec. 4. This strengthens the argument in that issue headed "Flying in the Face of Precedent," and reinforces some of the arguments in our symposium. If the six simple plants in Oklahoma were too complex and costly for small cities, what can be expected of the elaborate combination of electrolysis, lime treatment and thousands of revolving paddles, preceded by fine screens and followed by sedimentation, and yielding an immense volume of sludge, that has been so vigorously promoted farther east during the past few years?

Will Toronto Give Out Comparative Costs?

OKLAHOMA'S abandoned electrolytic sewage-works and the earlier plant abandoned at Danbury, Conn., cost little compared with the drifting-sand mechanical water filters at Toronto, discussed in our issue of Nov. 27-Dec. 4. It is only fair to say that Toronto had more to go on when it adopted this process than did the cities which built electrolytic sewage-treatment works, for Toronto operated a working-unit drifting-sand filter before contracting for its 72,000,000-gal. plant and could point to a few small municipal plants in regular use abroad. That is all past. Drifting-sand filters costing over a million dollars have been in operation long enough for those in charge to report purification results. Interest now centers in (1) the unit costs for operation and capital charges and (2) in a comparison of both purification and cost efficiency results with like figures for the slow-sand filters built a little earlier at Toronto. Thus far there has been silence on these points. Comparative data would be scanned eagerly by hundreds of engineers and city officials all over North America. May they be expected, and when?

Safeguard Investments in Roads

MR. PRIDE'S letter in this issue is most pertinent. In this billion-dollar highway construction era our attention is too apt to be centered upon types and mileages, and other issues are too apt to be obscured, if not obliterated. Not only should public officers who are intrusted with the expenditure of immense highway funds provide roads as nearly adequate to traffic requirements as a limited experience and an incomplete research allow, but they should take care to safeguard in every possible way the investment of a generous public. Road-building programs for the current year are generally extensive. Highway departments will be taxed, no doubt to their limits, in providing field and office forces to carry out these programs. But in the prosecution of such work those responsible for the administration of police powers must not forget that as great a responsibility rests upon them in guarding a public investment as rests upon the engineer in directing the original expenditure. Authority of those possessing police power is not vague. Statutes do exist in many states that limit the loading of vehicles; where there are none, they should be adopted without delay. When on the books, their enforcement is a matter of emphasizing equally all functions of highway departments, for it is as necessary for the engineer to hold responsible officials to the enforcement of existing legislation as it is for him to require careful construction by the contractor. Through such emphasis only can a full measure of co-operation be secured from road designer and builder, administrator and user, and the public that finances improvements.

Why Is the New Chief of Engineers Not Appointed?

NO SATISFACTORY explanation has yet come from Washington to account for the long delay, on the part of the Secretary of War, in naming the new Chief of Engineers, U. S. Army, although there is a rumor in circulation this week that the nomination has been forwarded to the President. For almost three months now the Corps of Engineers has been without a permanent head. A condition of this sort in any organization is generally the forerunner of unrest, inefficiency and lowered morale. It should not be allowed to continue. The delay would be unexplainable if there existed a dearth of officer personnel qualified to assume the responsibilities of head of the Corps. There is, however, no such shortage. In Colonel (lately Major-General) W. C. Langfitt there is available the former chief engineer of the American Expeditionary Forces, an officer eminently fitted to become the next Chief of Engineers. His more than two years of active duty in France, where he gained a thorough training in the combatant and non-combatant services which make up modern warfare, and his record of having handled with distinction, as head of the overseas Engineer forces, work involving executive capacity of a high order, would seem to single him out as the officer by whose elevation to permanent general rank the best interests of the Corps would be served.

Engineers, both in the Army and in civilian practice, are becoming decidly weary of the Fabian policy which the War Department is following in the case of the Engineer Corps. They are equally disgusted with Mr. Baker's spineless acquiescence in the practice which has apparently developed of discriminating against officers who have seen service overseas. In the matter of demotions from temporary rank it is the men who served with the A.E.F. who have suffered most, not the officers who got no nearer real action than a flat-top desk in Washington. It is a matter of speculation whether General Langfitt's prospects for promotion as things now stand in Washington, are not actually lessened by the fact that he served in France. There is said to be considerable friction between the men who served under General Pershing and the followers of General March, whose duties as Chief of Staff were performed at the national capital throughout the war.

It is important to furnish the corps quickly with an able, experienced leader. The corps is now merely drifting, and the members of the organization quite naturally are upset. With General Langfitt in charge there is every probability that a definite, wise policy would quickly be inaugurated. The corps must be headed by a strong man who can combat such influences as were evidently at work when the so-called March-Baker Army Bill—now apparently dead—endeavored by a broad usurpation of functions to shackle every one of the Army's Staff corps to the General Staff chariot. The decision has been pending since the first of November. It is high time for action.

The Classification and Compensation of Engineers

ENGINEERING Council's committee report on the compensation of engineers, presented at the Council meeting Dec. 18, is abstracted on p. 117 of this issue. The committee obtained records of the compensation of about 10,000 engineers employed by the Federal, state and muncipal governments and by the railways. With the sole exception of engineers engaged in shipbuilding work under the Government, who have benefited by the "Macy Award," the increases of salary to engineers in public service have been totally inadequate to offset the reduced value of the dollar.

Still more striking, if anything, is the fact that the heads of organizations employing engineers in public service, in their recommendations as to increases in salary to correct the injustice from which engineers now suffer, fail far short of increases sufficient to restore to the engineer the same rate of pay, measured in buying power, that he had in 1914 or 1915. It is clear that a campaign of education is necessary in order to make those who fix the pay of engineers understand what is justly due them. It is necessary, even, to give the engineer himself a proper understanding of what is really his due; and to encourage him, through every organization and means he can employ, to work for the establishment of the profession on the plane of compensation and public esteem which it belongs.

The first step in this campaign of education is to make widely known to the profession the information this committee has gathered; but this is only the first step. There must be a central organization which can make available to engineers everywhere the ammunition to use in appeals for proper compensation and which can co-operate and lead in every such movement. In this connection, the energetic work of the American Association of Engineers should serve as an example of what can be done.

Thus far Engineering Council committee has carried on its entire work by the voluntary service of its members, at large personal sacrifice of time and money. The work from now on assumes such magnitude that this method is no longer possible. The committee has asked Engineering Council for an appropriation of $10,000, to establish an organization which can successfully continue the campaign. Anyone who appreciates the size of the task and the expense such campaigns involve will realize that the $10,000 asked is a very small sum. The success of the effort for better pay depends entirely on the extent to which the profession will lend its financial support.

That there are great difficulties in the way of securing general acceptance of standard grades and salaries is, of course, true. The progress already made in such preliminary work as the committee has carried on, however, is very encouraging. It justifies the belief that if there is adequate financial support to the movement, the profession will gain millions of dollars annually in increased compensation. Nor will this gain be made at the expense of the public. The inevitable effect of the meager salaries which have been paid for the engineer's work in public service has been to injure the quality of that work. The economy and efficiency of public work, like private work, depends on the ability of the men placed in charge.

Now that the report is made, engineers must back it up not only with moral, but also with financial support. Without a well-organized campaign of education, vigorously pushed, the committee's work will go for naught.

An Appeal to Highway Contractors

ELSEWHERE in this issue is an appeal to the highway contractors of the country by R. G. Collins, Jr., the well-known New York contractor, now engaged in highway work at Cumberland, Md. He puts the situation clearly and correctly when he says that the contractors are not making money and that the public is not getting the roads. Moreover, if highway contracting continues to result for the contractor as unfortunately as it did in the year 1919, the highway program which the engineers are projecting cannot possibly be carried through. To get anywhere at all in the correction of difficulties, the contractors themselves need to come together, discuss frankly their difficulties, adopt the necessary measures where they themselves are at fault, and present to proper authority suggestions as to changes where the difficulties are beyond their control.

One gets an inkling of Mr. Collins' feeling in the matter from his article on "The Reason Why Contractors Lose Money on Highway Work," immediately succeeding his appeal. There are many new contractors doing highway work, and they have not figured properly upon the contingencies which must be met; but whether the chief reasons for the loss of money are to be found in the contractor's method of handling his work or in conditions imposed upon him by other parties, results that are worth while can only be expected if contractors generally understand the conditions and collectively work toward their removal. Nor need there be fear that if the contractors organize strongly they will try to impose upon the engineers. The latter always hold the whip hand. As we see the purpose of the organization which Mr. Collins urges upon his contractor brethern, it is to shed light upon their difficulties so that, proceeding intelligently and fairly, they may build up an agency, with fairness to themselves, which will be able to carry through the enormous highway program which the country is projecting. Loss to the contractors, if widespread and general, inevitably will spell loss to the public in the public's inability to get its highways built.

Engineering Council's Committee Reports on Compensation of Engineers

Presents Uniform Grading Plan for "Professional" and "Sub-Professional" Services—Standard Salary Schedule Submitted—Duties and Titles Defined

A CLASSIFICATION of engineers, based on technical qualifications and duties, a standard salary schedule with definite ranges of pay within the several grades specified, and a plea for $10,000 for carrying on the great volume of work involved are the main features of the report which the committee on classification and compensation of engineers, consisting of Arthur S. Tuttle, chairman; Francis Lee Stuart, John C. Hoyt, Charles Whiting Baker and M. O. Leighton, submitted Dec. 18 to Engineering Council. The extracts which follow contain the main features of the report:

Interest Has Increased

Since Oct. 15, the date of the committee's last report, general interest in bringing about additional compensation for engineers has clearly increased. The general agitation has resulted in some degree of advancement to engineers in various services but without improvement in conditions to an extent which can be deemed in any way satisfactory, particularly where the higher grades of service are concerned.

In the meantime the field investigation by the committee's Federal government section has been completed; a follow-up communication has been sent out by the state, county and municipal section to all services which failed to respond to the original questionnaire, with the result of bringing in many additional replies; a classification for engineers in the Federal, state, county, municipal, and railroad services, with corresponding titles, duties and qualifications, has been definitely agreed upon; and tentative schedules for compensation and promotion have been formulated.

Findings and Conclusions

The investigations have shown the lack of any adequate or consistent employment policy with respect to professional engineers. This is evidenced by the following conditions which are believed to be largely responsible for the unsatisfactory status of men engaged in this class of work:

1. Absence of any uniform system of grading of positions.
2. Lack of uniformity in titles of positions with respect to duties.
3. Inequalities in compensation for positions of the same grade.
4. Generally inadequate compensation for services rendered.

To the end that these conditions may be corrected and proper and equitable conditions of employment established, the following principles and practices are recommended:

1. Positions should be classified in accordance with the type of work, and with the character of the duties to be performed and the qualifications necessary for their performance, as indicated by a system of grading.
2. Within the salary limits fixed for each grade, there should be a system of advancement through the grade based upon experience gained in the position and upon proof of increase in the proficiency of the employee in performing the duties of the grade.
3. Promotions from grade to grade should depend upon the existence of a vacancy in the higher grade and proof that the employee is qualified to fill the vacancy.
4. The determination of salary adequate to procure for and retain in engineering work a high class of employees, should take into account and properly weigh the following considerations:

(a) The capital invested, both in money and in time, in obtaining the requisite fundamental training.

(b) The amount and character of experience and the degree of personal ability required.

(c) The relative value of the classes of work to be performed.

(d) The amount paid for similar service in other lines of work.

(e) The amount necessary to enable the employee to maintain a standard of living commensurate with the general standards of the community for positions of similar dignity and responsibility.

5. In the interest of an adequate social policy, no position likely to be occupied by individuals of an age to assume family responsibilities should fail to pay an amount sufficient to permit the maintenance of the average family in reasonable decency and comfort.
6. In the interest of the employees as a whole and of the employer, a system should be established by which employees who fail to maintain satisfactory standards of service should be removed, transferred, demoted, or retired as may be equitable in the circumstances.

Classification

After a number of conferences between members of the varous sections of the committee, an agreement was reached as to the classification which may properly be fixed for all of the services represented. This was planned in such a way as to conform in general with the principles laid down by the committee at the outset, and with the form of questionnaire which was used by each of the sections in conducting its inquiry.

It appears to be well adapted to use not only in all of the services represented but also for all other forms of engineering activity. Its adoption will not only remove occasion for the great variety of titles which now exists, but will also make it practicable to establish a comparison of the compensation given for service of the same general character in a wide variety of fields, and at the same time be of material assistance in bringing about the desired standardization with respect to minimum salaries for the various grades.

The grades proposed have been divided into two classes, the "professional service" being deemed to include men who have received an engineering degree from an educational institution of recognized standing or who have obtained similar qualifications through practice of the profession and by mastering the fundamentals of engineering science. The "sub-professional service" includes assistants with at least a high-school education, who enter upon the practice of the profession in the performance of responsible duties for which an engineering training is not essential, but who through experience and study may fit themselves for the higher

grades. The proposed classification is described in detail in appendix I.

Results of Investigation

The committee reviews briefly the work done in 1913 by a similar body of the American Society of Civil Engineers which reported that, from the meagre information obtained it was "convinced that the compensation for engineering work compares favorably with that received by men of any other profession." That a radical change of opinion has since taken place on the part of responsible department heads, is clearly evidenced by the fact that practically the entire Federal engineering service, except the War Department, has co-operated with Engineering Council's Committee in its inquiry, as have also 42 per cent of the state officials, and 70 per cent of the municipal officials to whom our inquiry has been addressed.

The financial status of 10,089 men in these services has now been revealed as compared with a total of 1,726 men who replied to the 1913-1916 inquiry. It also appears that those who responded in the previous investigation were largely confined to the engineers receiving maximum compensation. The average rate of present compensation shown by the new returns is as follows:

Service	Number of Men	Average Annual Compensation
Federal Government—Navy Department	594	$2,474
Federal Government (excluding War and Navy Depts.)	3,956	1,814
Federal Government (excluding War Dept.)	4,550	1,900
State	2,222	1,700
Municipal	3,317	1,820

In comparing these returns with those received by the Am. Soc. C. E. Committee four years ago, the decrease in the value of the dollar since then should be borne in mind.

Owing to a ruling made as to the railroad service, the committee, as heretofore reported, has been unable to obtain at first hand similar detailed information as to the present compensation of railroad engineers; but that existing conditions are similar to those in the three services investigated is generally admitted as is also the interest of men engaged in this service in bringing about a remedy.

According to an official report made by Director-General Hines, submitted to the Senate on Nov. 14, the average pay of 10,810 assistant engineers and draftsmen in railway service in December, 1917, was $3.92 per day or $1,254 for a year of 320 days. In July, 1919, there were 10,370 assistant engineers and draftsmen in the railway service whose average pay was $5.22 per day, or $1,670 for a year of 320 days. This is an increase of 33 per cent over the pay of 1917. The above records apparently apply to all the professional engineers in railway service except those classed as general or division officers.

A Serious Situation

It thus appears that 68 per cent of the engineers in the Federal service, other than the War Department, and 86 per cent of those in state and municipal service are receiving less pay than is required for the support of a family on a scale sufficient to provide for necessities (assumd at $2,200 per annum), to say nothing of the expense of giving children anything like the education with which the breadwinner was equipped.

It would seem reasonable to assume that men in the "junior aid" grade have not reached an age which would require compensation sufficient to support a family, but that the salary limitations for men in higher grades should clearly be sufficient to meet this need. On this basis it is safe to state that with anything like suitable compensation, not more than about 25 per cent of the entire engineering service, if properly organized should receive less than $2,200 per annum. The investigation made by the State and Municipal Section shows that the average age of the present incumbents of the lowest grades is actually about 27 years; if they are to be adequately provided for as permanent employees, the percentage of men to receive less than $2,200 is clearly negligible.

That a serious condition of unrest exists among engineers in the municipal and state services is clearly evidenced by explicit statements to that effect in 44 per cent of the questionnaires returned.

A comparison with the pay of the industrial worker who serves under the engineer also shows that the

SUMMARY OF PRESENT SALARIES BY GRADES IN FEDERAL SERVICE

Grade	General Description of Duties	16 Engineering Bureaus in Civil Establishments					4 Engineering Bureaus in Navy Department				
		No. of Persons	Present Pay per Annum			Per Cent Increase of the Average Since July 1, 1915	No. of Persons	Present Pay per Annum			Per Cent Increase of the Average Since July 1, 1915*
			Average	Maximum	Minimum			Average	Maximum	Minimum	
1	Chief administrative officer having full charge of organization, including determination of policy	15	$5,867	$10,000	$4,500	3.0	2	$9,450	$9,900*	$9,000*	0.0
2	Chief of major subdivision in responsible charge of large unit	83	3,801	7,500	1,800	5.0	4	6,381	9,000*	5,200	0.0
3	Chief of intermediate subdivision in responsible charge	209	3,104	5,000	1,800	9.9	22	4,312	5,634	2,304	57.6
4	Chief of minor subdivision	846	2,222	4,500	1,020	9.0	54	3,600	4,883	2,304	58.2
5	On general duty under direction but requiring special education and training and the use of initiative and originality	1,353	1,719	3,000	1,000	13.3	192	2,818	3,756	1,878	52.2
6 and 7	On subordinate duty requiring special education or training but not requiring special originality	1,092	1,293	2,817	600	12.0	218	1,954	4,257	1,500	38.4
8	On subordinate duty not requiring special education, training, or originality	169	975	1,340	480	19.3	81	1,379	2,254	1,002	37.2
...	On special duty of responsible character requiring special qualifications and initiative. Consulted (Excluded from Final Classification)	189	1,812	7,500	1,200	3.9	21	2,717	4,382	1,628	1.3
	Totals	3,956					594				

* Naval Officers, all others are civilian.

actual compensation paid for brawn is today greater than for engineering brain. The need for setting up some scale of compensation for the engineer to correct this serious condition is obvious, as is also that for the inquiry now being carried on by the committee.

Unless a radical improvement can be brought about, it seems evident that the profession cannot attract to or retain in it men of the caliber required to command the respect in which it has heretofore been held by the public. So long as engineers are continuously struggling with the problem of making even a bare living, their efficiency will be minimized and their incentive to work with other than a purely selfish interest will be lacking.

From the investigation made by each of the sections of the committee it appears that the heads of sixteen engineering bureaus in the Federal Government (excluding the Navy Department) have recommended an increase in present compensation averaging about 59 per cent, while similar increases for engineers in the state and municipal services, as recommended by the engineering heads, average only 26 per cent.

As a result of the inquiry now in progress under the direction of the Congressional Joint Commission on Reclassification of Salaries, the attention of all members of the Federal service has been drawn to this question in such a way as to make it one of close study and analysis, which condition doubtless accounts for the comparatively more modest recommendation made by the representatives of the State and Municipal services, whose reply to our inquiry has been individual and who have doubtless been confronted with the necessity of recognizing relationship to other workers in the same services in whose interests no concerted move of this character has been attempted.

The Federal section of the committee in formulating a standard compensation readjusted to the new conditions as to cost of living, has given special attention to the Macy Scale, this being dependent on an award made on Oct. 24, 1918, by the Shipping Wage Adjustment Board, which was designed to provide a uniform national wage scale for all shipbuilding workers, including a scale of compensation for draftsmen and copyists. This wage scale, which is generally known as the Macy scale, has since been adapted with modifications to the needs of certain bureaus in the Navy Department.

Proposed Standard Salary Schedule

Table I, showing standard salary ratings proposed for general adoption, has been prepared by the Federal Section of the Committee and is published for general discussion and criticism. The committee is not prepared at this time to recommend the final adoption of this schedule of compensation. It is not yet certain as to the wisdom of fixing even a minimum limit on the highest grades of service or of keeping the maximum of one grade below the minimum of the next grade also.

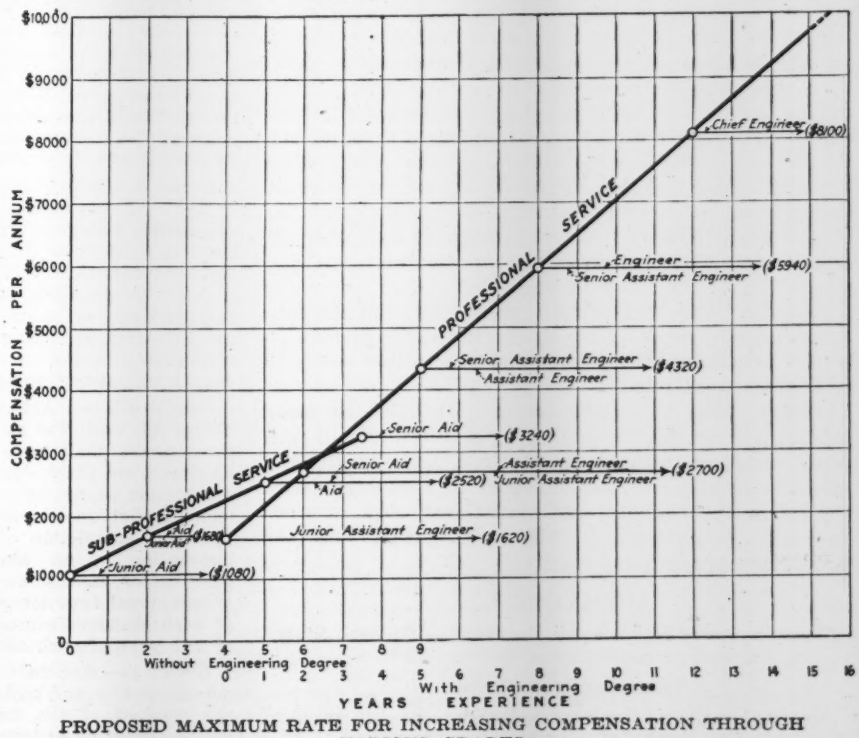
TABLE I. PROPOSED STANDARD SALARY SCHEDULE FOR ENGINEERS TENTATIVELY PROPOSED BY THE COMMITTEE

Grade	Total Years' Experience Required to Qualify With Professional Degree	Total Years' Experience Required to Qualify Without Professional Degree	Salary Range Minimum	Salary Range Maximum
8—Junior Aid	..	0	$1,080	$1,560
7—Aid	..	2	1,680	2,400
6—Senior Aid	..	5	2,520	3,240
5—Junior Assistant Engineer	0	4	1,620	2,580
4—Assistant Engineer	2	6	2,700	4,140
3—Senior Assistant Engineer	5	9	4,320	5,760
2—Engineer	8	12	5,940	No limit
1—Chief Engineer	12	16	8,100	No limit

The committee is also considering the provision to be made for advancement within the limits of a grade, for which a plan is suggested by the Federal Section. Under this plan it is proposed at yearly intervals, through ratings determined by a Personnel Board, to provide for awarding an increase in compensation to three-fourths of the men in a grade receiving less than the maximum compensation of the grade, who through fitness and industry have shown themselves to be of increased value to the service. Those in the highest third of this preferred list would each receive the maximum rate of increase, which under the proposed scale would be $480, while each of the next two-thirds would receive an increase of $240, the latter figure corresponding with what would then be the average increase for all of the men in the grade.

It would seem that pending the completion of the investigation, the scale of compensation herein presented and the plan for promotion within a grade is adapted to general use in all branches of engineering service.

Applying the average proposed salary to the present



PROPOSED MAXIMUM RATE FOR INCREASING COMPENSATION THROUGH VARIOUS GRADES

incumbents of these positions, as reported in the State and Municipal services, it will be found that there would be a resulting increase in annual compensation totalling about $5,500,000 as compared with a total increase of $2,500,000 recommended by the service heads, against which should, however, be charged the economy growing out of the increased efficiency brought about by a restoration of morale.

The committee believes, that a general discussion of this question is desirable and that the consensus of opinion on the part of all concerned should be obtained.

Recommendations

The committee recommends:

First: That the classification of engineers in Federal, State, County, Municipal, and Railroad services, with the corresponding specifications as to qualifications and duties, as now submitted by the committee, be approved and recommended for general adoption, and that this action be communicated to all Federal, State, Municipal, and Railroad officials directly concerned, the list of such officials to include heads of Federal Bureaus, Governors, Mayors, Civil Service Commissioners, State Engineers, City Engineers, and Regional Directors, and that the assistance of national and local engineering societies and of the engineering press be invoked, to the end that general recognition of this classification may be secured. And also that pending the formal adoption of a plan for compensation and promotion, the one tentatively proposed by the Committee be recommended for use in the meantime.

Second: That active measures be advocated in the direction of bringing about uniform and general legislation of a suitable character to provide for the registration of engineers, in order that the proposed classification of professional engineering service may be insured the respect to which it should be entitled.

Third: That active steps be taken to obtain the views of the heads of all engineering bureaus representing federal, state, municipal, and railroad services as to the reasonableness of the schedule of compensation and as to the plan for advance within the limits of the grades as now tentatively proposed, as well as of other engineers affected directly or indirectly, through the sending out of another questionnaire to be prepared by the Committee, and that at the same time the views of engineers in all other branches of service be sought as to the adaptability of the recommended classification and of the tentative schedule for compensation and promotion, to their respective fields.

Fourth: That a sufficiently great edition of the substance of this report, suitably arranged, be printed to permit of giving it the maximum practicable publicity in engineering circles.

Fifth: That an appropriation of $10,000 be made available to provide for employing a secretary and such other assistants as may be required, and for meeting other incidental expenses involved in connection with the follow-up, publicity, and educational work required for the completion of this investigation and the production of practical results.

APPENDIX I.

Classification of Engineering Positions in Federal, State, County, Municipal, and Railroad Service

Professional Service

Grade 1 — Chief Engineer — Duties: To act in chief administrative charge of a technical organization or of a main division thereof; to determine the general policies of the organization under the limitations imposed by law, regulation, or other fixed requirement; to have final responsibility for the preparation of reports, cost estimates, designs, and specifications for the construction, maintenance or operation of engineering works or projects; to have full charge of the collection and presentation of data for and the conduct of valuation proceedings; to conduct or direct the most comprehensive lines of engineering research.

Qualifications: Training and experience of a character to give substantial evidence of engineering knowledge and ability or of executive capacity of highest order along lines of work similar to those involved in the position to be occupied and of at least twelve years' duration, of which at least four years shall have been spent in duties of Engineer, or their equivalent, and at least five years in responsible charge of important work or projects. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing or, in abence of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Grade 2—Engineer—Duties: Under general administrative direction and within the limits of the general policies of the organization, to have responsible charge of and to initiate and determine policies for a major subdivision of an organization; to prepare for final executive action reports, cost estimates, designs, specifications, and valuation studies and data; to have immediate charge of the construction, maintenance, or operation of engineering works or projects of major importance; to conduct or direct major lines of engineering research; or to furnish for executive action expert or critical advice on engineering works, projects or policies.

Qualifications: Active professional practice or executive charge of work for at least eight years, of a character to demonstrate a high degree of initiative and of ability in the administration, design, or construction of engineering work or projects of major importance, of which at least three years shall have been spent in duties of Senior Assistant Engineer, or their equivalent, and at least three years in responsible charge of work. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing or, in absence of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Grade 3 — Senior Assistant Engineer — Duties: Under general administrative and technical direction, to be in responsible charge of an intermediate division of an organization; to exercise independent engineering judgment and assume responsibility in studies and computations necessary for the preparation of reports, cost estimates, designs, specifications, or valuations; to have immediate charge of the construction, maintenance, or operation of important engineering works or projects; or to conduct or direct important lines of engineering research.

Qualifications: Active professional practice or executive charge of work for at least five years, of which at least three years shall have been spent in duties of Assistant Engineer, or their equivalent, with at least one year in responsible charge of work. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing or, in absence of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Grade 4 — Assistant Engineer — Duties: Under specific administrative and technical direction, to be responsible for the conduct of the work of a minor subdivision of an organization; to collect and compile data for specific items

of engineering studies; to take immediate charge of field survey projects and of the design and construction of minor engineering work; to lay out and develop work from specifications and to supervise the work of a drafting or computing force; or to conduct specific tests or investigations of apparatus, material, or processes.

Qualifications: Experience for at least two years in duties of Junior Assistant Engineer or their equivalent. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing or, in absence of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Grade 5—Junior Assistant Engineer—Duties: Under immediate supervision, to perform work involving the use of surveying, measuring, and drafting instruments; to take charge of parties on survey or construction work; to design details from sketches or specifications; to compute and compile data for reports or records; to inspect or investigate minor details of engineering work; or to perform routine tests of apparatus, material, or processes.

Qualifications: No experience required other than that involved in securing a professional degree upon the completion of a standard course of engineering instruction in an educational institution of recognized standing; but in absence of such degree, a high school education or its equivalent is required and at least four years' expereince in the use of surveying, measuring or drafting instruments, or the computation and compilation of engineering data, together with evidence of a knowledge of the fundamentals of engineering science sufficient, with further experience, to qualify for the higher professional grades. The completion of each full year of such standard course of engineering instruction shall be considered as the equivalent of one year of experience.

Sub-Professional Service

Grade 6—Senior Aid—Office—Duties: To supervise the plotting of notes and maps, and to direct the work of a drafting or computing squad.

Qualifications: Experience for at least five years in tracing, lettering, drafting, and computing, of which at least three years shall have been spent in the duties of draftsman. Education equivalent to graduation from high school. The completion of each full year of a standard course of engineering instruction in an educational institution of recognized standing shall be considered as the equivalent of the experience otherwise required, with the provision, however, that at least one year shall have been spent in the duties of draftsman.

Grade 6—Senior Aid—Field—Duties: To direct work of field party on surveys or construction; to keep survey notes and engineering records; to supervise construction or repair work; to direct the work of computing surveys and estimates; to direct the work of making minor engineering computations.

Qualifications: Experience for at least five years in the use and care of surveying instruments, of which at least three years shall have been spent in the duties of instrumentman. Education equivalent to graduation from high school. The completion of each full year of a standard course of engineering instruction in an educational institution of recognized standing shall be considered as the equivalent of the experience otherwise required, with the provision, however, that at least one year shall have been spent in the duties of instrumentman.

Grade 7—Aid—Office—Duties: To prepare general working drawings where design is furnished; to plot notes and prepare maps; to design simple structures; to make computations and compile data for reports and records; to check plans, surveys, and other engineering data.

Qualifications: Experience for at least two years in tracing, lettering, drafting, and computing. Education equivalent to graduation from high school and familiarity with the use of the slide rule, and of logarithmic and other simple mathematical tables. The completion of each full year of a standard course of engineering instruction in an educational institution of recognized standing shall be considered as the equivalent of the experience otherwise required.

Grade 7—Aid—Field—Duties: To run surveying instruments and to adjust and care for same; to compute surveys and estimates; to make minor engineering computations; to inspect incidentally construction or repair work.

Qualifications: Experience for at least two years in the duties of rodman. Education equivalent to graduation from high school and familiarity with the construction, operation, and care of surveying instruments. The completion of each full year of a standard course of engineering instruction in an educational institution of recognized standing shall be considered as the equivalent of the experience otherwise required.

Grade 8—Junior Aid—Office—Duties: To trace and letter maps and plans; to make simple drawings from sketches and data; to make minor calculations.

Qualifications: Education equivalent to graduation from high school.

Grade 8—Junior Aid—Field—Duties: To run tape or levelling rod; to perform other miscellaneous subordinate duties in survey party in field or office, as directed.

Qualifications: Education equivalent to graduation from high school.

Experience Equivalents for Post-Graduate Work

An examination of the schedule shows that the minimum experience requirements for the various grades may be briefly summarized as follows:

Service	Grade No.	Title	Education Experience in Years: With Degree in Engineering	Without Degree in Engineering
Sub-professional	8	Junior Aid	0	0
Sub-professional	7	Aid	0	2
Sub-professional	6	Senior Aid	0	5
Professional	5	Junior Assistant Engineer	0	4
Professional	4	Assistant Engineer	2	6
Professional	3	Senior Assistant Engineer	5	9
Professional	2	Engineer	8	12
Professional	1	Chief Engineer	12	16

Typical Classes of Positions

The following table illustrates the practicability of adapting the proposed classification to any particular grade or branch of the engineering service and in such a way as to clearly retain a description of the relative rank.

PROFESSIONAL SERVICE

1—Chief Engineer

Chief Engineer	Deputy Chief Engineer
State Engineer	Deputy City Engineer
City Engineer	Director, etc.

2—Engineer

Electrical Engineer	Maintenance of Way Engineer
Mechanical Engineer	Signal Engineer
Mining Engineer	Highway Engineer
Chemical Engineer	Division Engineer
Bridge Engineer	District Engineer
Sanitary Engineer	Sewer Engineer
Tunnel Engineer	

(Similar descriptive titles could be used with the terms "Senior Assistant Engineer," "Assistant Engineer" and "Junior Assistant Engineer.")

SUB-PROFESSIONAL SRVICE

6—Senior Aid

Office—Chief Draftsman	Field—Chief Instrumentman
Office—Chief Computer	Filed—Chief Inspector

7—Aid

Office—Draftsman	Field—Instrumentman
Office—Computer	Field—Ihspector

8—Junior Aid

Office—Junior Draftsman	Field—Rodman
Office—Tracer	Field—Tapeman

The completion of each full year of post-graduate work in the specific subject of study or investigation appropriate to a particular service or branch of service shall be considered the equivalent of one and one-half years of general experience, but such substitution shall not thus be made for more than four years of such experience or be considered as reducing the requirements in any grade of the number of years engaged in the conduct or direction of responsible work.

An Appeal to Highway Contractors

THE people of the United States demand good highways and have backed up that demand by making available for this year's work between $600,000,000 and $700,000,000.

With this tremendous program before us what condition do we find?

The highways are being strewn with the wrecks of contractors' organizations—and consequently

The public is not getting the highways.

During 1919 contractors built $136,000,000 worth of highways. How many of them made a dollar? How many of them lost dollars?

We all know that highway construction was a losing game last year for the contractor, and unproductive, for the public.

Is this to be allowed to continue? If not, how are we, in the public's interest as well as our own, going about to help secure a change?

The first and most obvious thing to do is for every last one of us—large contractor and small—to get together. Practically every line of manufacture and many lines of construction are organized. The members get together frequently to discuss conditions, prices — everything affecting their business interests. Highway contractors, on the other hand, are unorganized.

The volume of highway work to be done is so enormous that there is plenty for all of us. To carry through the program in an American way — quickly, economically, profitably — our present point of view, our method of estimating and handling work must be changed. By present procedure, we are not getting the work done.

There is planned a Highway Contractors' Section of the Associated General Contractors, and although preliminary steps were taken in Chicago in November, 1919, in that direction, a grand opportunity for definitely launching the section is offered at the meeting of the association to be held in Chicago, Feb. 18. Whether a member of the association or not, let every contractor interested in highway construction be there, and let us start something worth while.

This is not a call from the Associated General Contractors. The writer is making an appeal on his personal responsibility. We must have an organization of some kind. Many of us are members of the A.G.C. already, and it seems at this time to be the best under which to get together.

If we do get together, become acquainted and discuss the situation carefully, we surely can evolve plans that will enable the contractor to live and grow, and thus, in turn, permit the successful handling of the enormous highway program for which the public is putting up the funds.

R. G. COLLINS, Jr.,
Contracting Engineer.
Cumberland, Md.

Why Is There No Profit in Building Highways?

BY R. G. COLLINS, JR.
Contracting Engineer, Cumberland, Md.

WHY *have contractors failed to find a profit in building highways?*

With a fund of approximately $3,000,000,000 available within the next five years for a certain line of public improvement, demanded by the public, and to be executed by contractors, it seems that the above question should be given considerable thought before bids are made for the coming season's rush, which is estimated to total about $630,000,000.

The answer seems relatively simple to one who has come through the mill, and it is simply this:

Contractors have underestimated the many, always present factors which tend to cut down the monthly output of work, and have therefore bid too low.

You may have a first-class organization and equipment easily capable of building 600 to 700 ft. of 16-ft. road in ten hours, but the trouble is that the organization expense goes on every day in the month and season, *and so do the factors which cut down the output.*

ADVERSE FACTORS

The Weather—Contractors cannot figure without considering the weather and the best they can do in highway-building work is to minimize its delay by putting in industrial equipment, so that the delay is confined to the storm period and not to the muddy hauling condition and ruined subgrade produced by the storm. These conditions may continue for several days, and possibly until another storm comes.

Inspection Difficulties and Too Rigid Interpretation of Specifications—Contractors have always had to contend with inspection difficulties and too rigid interpretation of specifications, and have no reason to suppose that they will be less insisted upon in road work. State highway engineers at their convention in Louisville last month showed a disposition to take up in a fair-minded manner all the criticisms made of their specifications, their interpretations and procedure brought up in the paper presented by a representative of the Asociated General Contractors. This subject is already under investigation by a joint committee of the two organizations just mentioned.

Shortage of Materials—Delay from shortage of materials can be minimized by stocking up as soon as the contract is signed and while advancing the grading and "fine grading," *but* the danger is always there.

Shortage of Labor—Shortage of labor can be minimized by the use of machinery wherever possible, but even then there will be machinery breakdowns for which allowance must be made.

The whole thing in a nutshell is just this:

Contractors have always had to confront and to battle with these adverse conditions. Why then demand that they be done away with?

To get some idea of how these factors affect the job, let us look at a few figures:

There is no doubt that the only way for a contractor to tackle highway construction in sections over 4 mi. in length is to put in cranes, 2-ft. gage tracks, cars and equipment, etc., to do away with common labor wherever possible. He must figure on having enough of this equipment, too; not 2 locomotives and 20 or 30 cars for a 10-mi. section, but 6 locomotives (3-ton) and 60 cars, 6 mi. of track and plenty of switches. This plant will cost from $80,000 to $90,000, and the depreciation and interest on this investment will come to at least 20 to 30c. per sq.yd. of pavement, for a 10-mi. contract of

16-ft. road. (Figuring that the plant cost is to be wiped out in three years.)

He must install a properly laid out yard for his material handling and storage, with probably his own railroad siding. A trestle is worth while on a section over 5 mi. long. This yard, trestle, siding, cement shed, etc., will cost him around $5,500 or 5½c. per sq.yd. on a 10-mi. contract (94,000 sq.yd.).

Laying his first narrow-gage tracks will cost 2c. per sq.yd., shifting and maintaining same being included in payroll.

His loss in small tools will amount to 2c. sq.yd. of pavement.

Freight to and from the contract, installation of equipment, arrangement of good housing for his labor will cost 5c.

His bond on the concrete item alone will cost between 4 and 4½c.

In all there is a total of 30c. per sq.yd. for equipment and 19c. for the other items.

This all sounds like a formidable handicap to carry along as a constant charge, *but* it is attendant upon this method of construction, which is admittedly the cheapest now available, for with this equipment we can count on the largest season's performance in the face of known difficulties.

If a contractor could have some insurance that, having purchased an equipment of this kind, it would be kept at work, as is the equipment of a contractor on railroad work, the 30c. charge might be reduced. Under present conditions, the figure is not high enough.

In this year, the contractor, in addition, will need to take particular care of his financing before bidding on work, as the purchase of machinery and materials on long terms is practically a thing of the past. Formerly in buying equipment similar to that needed for this work, very little cash was required at time of purchase, the remaining payments to be strung out over periods of six to twelve months. Now a large initial cash payment is demanded and the balance must be paid within four months.

Bonding companies also show a tendency to require a stronger financial standing and broader experience for applicants for bonds on road work.

Performance

The equipment described when properly manned and handled can reasonably be said to have a capacity for placing 750 ft. of 16-ft. highway, 7-in. thick, in 10 hours, but if a contractor figures, in making his estimate, on accomplishing more than 12,000 sq.yd. in a month (300 ft. for each of 23 full days per month), he is making a sad, but sure, mistake. If the contractor risks any other form of haulage than industrial equipment, he should not figure on accomplishing more than half of the above yardage per month.

He *should* exceed this monthly performance, but so far not five contractors in the country have equalled it for each month that they were on a contract, *so why figure on something which is possible, but hasn't yet been accomplished, particularly when the factors preventing the accomplishment are beyond the contractor's control?*

Most highway contracts average from 3,000 to 5,000 cu.yd. of excavation per mile, and experience shows that for this class of grading there is not much profit at $1.50 per cu.yd., because the material has to be almost always loaded (steam-shovel work) and placed in fills, and then *must be rolled thoroughly and brought to the exact plane called for by the engineer's stakes.* There is no profit to be made in culvert masonry, even at $18 or $20 per cu.yd., so that practically the entire profit of the contract must be made in the placing of the concrete pavement.

How many bid on this basis, and yet wherein is this basis of arriving at the cost to the contractor not absolutely correct?

Pipe Sprinkler System for Long Bridge

A PIPE sprinkling system installed on the Mississippi River bridge between St. Louis, Mo., and Venice, Ill., is intended to eliminate the use of a sprinkling cart, to preserve the wood floor by preventing excessive shrinkage in hot weather, and to reduce the danger of fire. The floor consists of large blocks 3 x 4 ft., built up of planks on edge, bolted together. There

SPRINKLER PIPE THROWS JETS OVER WOOD FLOOR OF BRIDGE

are two roadways, 14 ft. wide between guard timbers. The length of bridge to be equipped for sprinkling is 7,000 feet.

A 4-in. feeder main is laid behind and above the outer guard timber of each roadway, and has valves and hose connections for fire service. A pressure of 40 lb. is carried. For the sprinkler service, the bridge is divided into 15 sections of about 500 ft., and at the middle of each section the main is tapped with a ½-in. connection controlled by an angle valve. A branch connects this with a ½-in. pipe just below the main and laid along the top of the guard timber for 250 ft. in each direction.

These pipes are drilled with holes spaced 2 ft. apart at angles alternately 5° above and 5° below a horizontal plane and fitted with sprayers or nozzles arranged to throw alternate jets across the roadway at two angles. The orifices of the sprayers vary from No. 47 to No. 49 gage, increasing from the valve to the end of the section in order to compensate for loss due to friction and thus provide practically a uniform flow from all the nozzles.

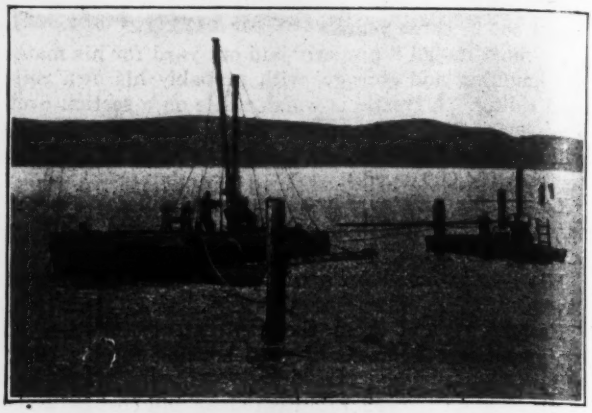
This sprinkling system is operated by the watchman or bridge tenders, who see that the floor is kept suffi-

ciently moist to insure protection from fire and to provide the best wearing conditions for the paving. The water consumption is about the same as with sprinkler carts, but the latter could not keep the surface continually moist and interrupted traffic somewhat. Water taken directly from the river is supplied by a pumping plant in the electric-railway power station at the east end of the bridge. The system was devised by W. B. Huckaby, bridge superintendent, and was installed by him under the direction of E. D. Bell, general superintendent of the St. Louis Terminal Ry. (Illinois Traction System), which owns and operates the bridge.

Steel Pipe Floated to Place, Sunk and Bolted Under Water, To Form Outfall

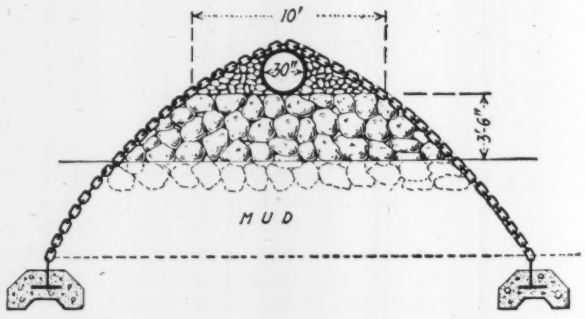
THE town of Queensborough in Tasmania has laid 700 ft. of 30-in.-steel outfall sewer pipe on a rock-fill foundation in the bed of the River Derwent by making each section buoyant, floating it to place, and flooding and sinking it for connection by a diver. The sewer was required for a separate drainage system caring for an area of 1100 acres and designed to provide for an ultimate population of 27,000. Its point of discharge is 26.5 ft. below low water. The pipe was made up of ½-in. steel plates in approximately 24-ft. lengths.

The bed of the river consisted of 5 ft. of mud lying on sand. A single row of guide piles was driven at 100-ft. intervals, and alongside these a stone foundation was dumped and graded. A punt, 36 x 18 x 4 ft., was equipped with two crab winches and timber outriggers fitted with block and tackle for adjusting levels of the sections being placed. The punt was located and made fast over the place where the pipe section was to be laid. On the river bank the pipes were bolted in 48-ft. lengths, and temporary timber bulkheads were fastened to the ends of each of these sections. A section was then launched from the bank, as shown in the accompanying picture, and towed to its location between the punt and guide piles. It was there lined with targets on the guide piles. Its timber bulkheads were removed, allowing the section to fill from the ends. Guided by the tackle of the punt, the pipe was sunk, bedded on its foundation, and then



ALIGNING FLOATING PIPE BEFORE FLOODING AND SINKING

bolted to the preceding section by a diver. The pipe line was tied in place every 100 ft. by a special anchorage chain, each end of which was made fast to concrete blocks embedded in the mud. As a final operation, the line was covered with an additional



CROSS-SECTION OF OUTFALL SEWER

rock fill, as shown in the cross-section. The guide piles were then removed upon completion of the work.

The engineer responsible for the design and execution of the work is H. E. Bellamy, Mem. Am. Soc. C. E., city engineer, of Hobart, Tasmania.

LAUNCHING 48-FOOT BULKHEADED SECTION OF STEEL PIPE TO BE FLOATED TO POINT OF PLACING IN RIVER BED

Rental Values for Construction Equipment

By F. J. HERLIHY
Concrete Department, Winston Bros. Co., Minneapolis, Minn.

Of the various elements of the cost of construction work there is none more important or on which there is a wider divergence of opinion than the value of plant rental. Contracting is a business in the same sense as is the mercantile trade and, to be successful, must be conducted on sound business principles. Each disbursement made must be properly charged against the product the contractor has to sell, i.e., against the structure he has contracted to build. Cost elements such as labor, material and items of expense incurred exclusively for the work in question can be charged to that work in their entirety and consequently present no especial difficulty.

In the case of plant cost, however, the foregoing principle does not apply, as a machine such as a steam shovel or hoisting engine, is bought not exclusively for a single job, but as a capital investment for future work. The first cost of equipment, then, can not be charged against any one job, but together with the accruing costs, such as interest, insurance, etc., it must be charged against all the work the equipment may reasonably be expected to execute throughout its useful life. The particular work in hand should only bear the cost to the contractor of owning the equipment while on that work, together with its share of the cost during the idle time between contracts.

There is a regrettable lack of uniformity in the charges made by contractors against construction work for plant rental. This condition can only result in throwing bids out of line. In cases where too high rental charges are made, the result is correspondingly high bids, but it is more serious when too low a plant charge is made. This often results in an actual loss, or at least in a reduction of or wiping out of the anticipated profit. This loss may not always be apparent as the contractor has nothing on his books to show the loss. He still has the plant on which this charge will not appear until the end of its useful life.

The essential thing for the contractor to ascertain at the outset when bidding on work is, of course, the value of the work to be done. This can only be ascertained after each element of cost of the contemplated work has been carefully analyzed and more especially is this true in these times of rapidly fluctuating prices. In this connection the accurate value of plant rental is equally important with the items of labor, supplies or any other cost element of the work. The true cost to the contractor of owning the plant and maintaining it in useful condition must be the basis on which the value of plant rental charges are founded. Fictitious values which only confuse the records should be discarded and no element of profit should be incorporated in the plant cost. Profits should be taken care of in the regular profit element of the estimate where they can be most properly handled.

It is obvious then, if our premise be correct, that the vital problem to solve is a determination of the cost to the contractor of owning equipment and maintaining it in useful condition throughout its life. This problem is a large one indeed and can only be solved by analyzing the different elements of plant cost, both capital and accrued, separately.

The cost to the contractor of owning equipment may be broadly defined as comprising: 1, capital investment; 2, interest on capital investment; 3, insurance; and 4, storage expense during idle time. The cost of maintaining the equipment in useful condition includes the cost of ordinary running and field repairs and the cost of general or shop repairs. The accompanying table is submitted as a convenient form in which to express the different elements of cost of plant rental, as well as to set down the results of the analysis. While the principles of plant rental are similar for all classes of contractors equipment, only the most commonly used units of grading contractors equipment will be considered here. In order to simplify the results and make the analysis more comprehensive, the table is so constructed that all charges are measured in terms of original cost, which is the known quantity in every instance. The column headed "Original capital cost" is intended to show typical costs only and is given as a basis on which the details of plant rental—both costs and percentages—are worked out. In actual practice the true first cost of the equipment should be substituted for that shown in the table and the analysis worked out accordingly, using as the other factors, the fixed percentages shown. Where the contractor owns several machines of the same class, size and type, which cost different prices, the average original cost should be used. Average depreciation only is considered in fixing the various factors of accrued costs, and charges shown in the table as depreciation will vary for the different makes of equipment on the same class of work and will be dependent more or less on the nature of the work for all classes of equipment. Average equipment working under ordinary conditions, covering the entire time the contractor may be in business, is considered. The figures shown in the table for repair items are based on present prices and average conditions. They will vary with the fluctuation of the labor and material market and with the different makes of equipment, depending more or less on the character of the work and the manner in which the equipment is handled. The percentage rate of depreciation and the average earning days per annum are quantities that experience alone can measure, a perusal of the records of contractors who have been using the class of equipment under consideration for an appreciable time being the only source of information. The factors used in the table for depreciation, average earning days per annum, and shop and field repairs show the writer's conclusions of their values based on his general experience, a perusal of extensive data on the subject and the records of a large grading contractor. Additional information was secured from several months' attendance at arbitration proceedings in which more than $600,000 worth of rental charges on equipment, similar to that shown in the table, were part of the issue. Several weeks were spent on the principles and rates of rental exclusively, and much expert testimony was adduced by both sides. The finding of the arbitrators, while not allowing all rental claimed for other reasons, approved the rates of rental contended for and the principles thereof in most instances. The rental rates in that case were based on

practically the same percentages and principles as those in the table shown here, the cost of repairs being practically the only departure. As the rental factors in that case were based on pre-war conditions, this departure is necessary to bring the cost of these items into conformity with present values. Proceeding to analyze the different cost elements, we have:—

Different Cost Elements

Original Capital Cost.—This element represents the first cost of the equipment which must be recovered by charging off the depreciation periodically and from the proceeds of its sale at the end of its useful life. In fixing the annual rate of depreciation (average between idle and working time) due credit has been given the first cost of the equipment for its scrap or obsolescent value. The rate shown represents simply the rate of depreciation reduced to terms of original cost, which, if applied annually, against the first cost, will take care of the difference between first cost and the sale price at the end of the useful life. Obsolescence is considered as being reached with any piece of equipment when it must be discarded for one that will do the work more economically.

Interest on Capital Investment.—The rate shown in the table represents the rate, which, if applied annually against the first cost of the equipment, will take care of interest charges against the capital investment throughout the useful life of the equipment at the customary rate of 6 per cent per annum on the average capital value. Assuming the sale price at the end of the useful life at 25 per cent of the first cost, this makes the average capital value 62½ per cent of the first cost. For machines which have no sale price at the end of the useful life, the average capital value becomes 50 per cent of the first cost.

Insurance and Storage During Idle Time.—These two items of expense have been combined in the table because they are more or less related and the insurance item is less than one per cent per annum of the original capital cost. Most contractors find it more economical and certainly more satisfactory to have a central storage plant for equipment, so located that it will be easily accessible from, and in close proximity to, headquarters, than to have their equipment scattered about at several storage points. The charge for these elements of cost include interest, depreciation and maintenance of storage facilities, and all expense incurred for the storage of equipment, whether stored at the central storage plant or elsewhere. It also includes the expense of insurance on storage facilities and construction equipment. Where no insurance is carried, the contractor should make a charge for this item in any event as then the contractor assumes the risk. The annual percentage rate shown in the table is based on an annual cost of $15,000 to cover these items of expense on a construction plant, the first cost of which was $400,000. Of course this expense will vary with the quantity of equipment owned by the contractor and the value of the storage facilities, but the rate shown should be fairly representative for all conditions.

The columns headed "Rate of accrued charges on original cost" and "Total annual charge" in the table sum up the percentage and money charge, respectively, that must be applied annually against the first cost of each piece of equipment. These columns simply sum up the interest, depreciation, insurance and storage items just described. The values in the column headed "Total annual charge" will vary with the original capital cost, but those shown in the percentage column will remain constant and they are the key to finding the actual annual charge to be made in all cases.

Having arrived at the annual cost to the contractor of owning the equipment, the next thing to ascertain is how to apply the charge against the different contracts in order to come out whole. In making this application, it is necessary to understand that there is of necessity a certain amount of idle time between contracts during which the contractor has no work against which to apply the accrued costs of owning the equipment, and that contractors engage in the contracting business to stay indefinitely. It naturally follows that the contractor must carry on hand at all times enough equipment to enable him to bid on work with a certainty that he can equip the work in the time provided for by the specifications. The contractor, therefore, who fails to include charges in his plant rental rate during the earning time of the equipment that will absorb the accrued costs during the idle time between contracts upsets the very foundations of sound business principles and faces inevitable losses, either by way of being forced to dispose of the equipment quickly at the best price obtainable, or by assuming the accrued costs of holding it during the idle time between contracts. Of course, there is the alternative of renting the equipment during the idle time but that too has its uncertainties, as a renter will not always be available. If these premises are correct, the number of earning days, or the number of calendar days on which the equipment is assigned to work per annum is the factor to apply to the total annual charge in arriving at the correct daily rental charge to be made against the work. By this method, the total accrued costs of owning the equipment is absorbed by the earning time of the equipment and the enforced idle costs properly accounted for. The average number of earning days per year for the different classes of equipment, based on the information described at the beginning of this analysis is shown in the table. The values shown represent the number of calendar days and not actual working days intervening between the time the equipment has been shipped to the work and its return to the storage plant, or until it has been assigned to another job. In other words, rental should be charged against the work for each and every calendar day on which the equipment is assigned to the work, working days being too uncertain a factor on which to base. The column headed "Daily charge for interest, depreciation, insurance and storage" represents the values arrived at by dividing the annual charge for accrued expenses and charges by the average number of earning days per year. The rates shown in the column should be used only in making charges on work of such duration as to permit of shop and field repairs being charged directly against the work.

Maintaining Equipment in Useful Condition

Having disposed of the cost to the contractor of owning the equipment, there remains the expense of maintaining it in useful condition. This expense, as before stated, comprises the elements of general or shop repairs, and of field repairs. All construction equip-

ment must be overhauled, and renewals and major repairs, commonly designated as shop repairs, made periodically. The cost of these repairs per earning day, is shown in the table. The expense of making these repairs cannot ordinarily be charged directly against the work, as they usually accrue on several contracts. The most satisfactory method of handling them is to provide a sinking fund by charging in the rental rate an amount daily that will accumulate a fund sufficient to cover the cost of these repairs at such periods as they are required. It is this daily charge that is shown in the column headed "General shop repairs daily" in the table.

Daily Rental Value Including Shop Repairs.—In the column of the table headed "Daily rental" will be found the values of rental per earning day for the different classes of equipment, including the allowance for sinking fund to take care of shop repairs. This represents the daily rental charge that should be made against each piece of equipment on ordinary work to take care of the annual charge and shop repairs. It is the values shown in this column of the table that should be used for all jobs except those which are of too short duration to allow for field repairs to be charged directly against the work and those which are long enough to allow both field and shop repairs to be charged directly against the work.

Field Repairs.—Field repairs are generally charged up directly against the work. They comprise simply such minor repairs and replacements as are due to the ordinary breakage and wear of parts that must be taken care of on the job to keep the equipment running. The column headed "Est. cost field repairs daily" gives the value of these repairs per earning day.

Total Rental Charges

There is a final column in the table, headed "Total rental charges daily including field repairs" in which the daily charge shown in the column headed "Daily rental" is augmented by the addition of the field repair charge. This column is given for the information of the estimator who is concerned only with the total cost

RENTAL RATES FOR GRADING CONTRACTORS EQUIPMENT

Class of Equipment	Original Capital Cost	Equivalent Annual Interest Rate on Original Cost, Per Cent	Annual Rate of Depreciation on Original Cost, Per Cent	Annual Insurance and Storage Rate on Original Cost, Per Cent	Total Annual Rate of Accrued Charges on Original Cost, Per Cent	Total Annual Charge	Average Earning Days per Year	Daily Charge for Int. Dep. Ins. and Storage	General Shop Repairs Daily	Daily Rental	Estimated Cost Field Repairs Daily	Total Rental Charge Daily, including Field Repairs
Steam shovel	$12,000	3½	12½	3½	20	$2,400.00	200	$12.00	$4.00	$16.00	$4.00	$20.00
Steam shovel	20,000	3½	12½	3½	20	4,000.00	200	20.00	6.00	26.00	6.00	32.00
Steam shovel	30,000	3½	12½	3½	20	6,000.00	200	30.00	9.00	39.00	9.00	48.00
Steam shovel	90,000	3½	12½	3½	20	18,000.00	200	90.00	25.00	115.00	25.00	140.00
Drag line excavator	20,000	3½	12½	3½	20	4,000.00	200	20.00	10.00	30.00	10.00	40.00
Drag line excavator	30,000	3½	12½	3½	20	6,000.00	200	30.00	15.00	45.00	15.00	60.00
Standard gage locomotive	12,000	3½	12½	3½	20	2,400.00	200	12.00	5.00	17.00	5.00	22.00
Standard gage locomotive	16,000	3½	7½	3½	15	2,400.00	200	12.00	6.00	18.00	6.00	24.00
Standard gage locomotive	24,000	3½	7½	3½	15	3,600.00	200	18.00	8.00	26.00	8.00	34.00
Dinkey locomotive	4,000	3½	12½	3½	20	800.00	200	4.00	1.50	5.50	1.50	7.00
Dinkey locomotive	6,000	3½	12½	3½	20	1,200.00	200	6.00	2.50	8.50	2.50	11.00
Locomotive crane	20,000	3½	12½	3½	20	4,000.00	200	20.00	6.00	26.00	6.00	32.00
Jordansreader	9,000	3½	12½	3½	20	1,800.00	200	9.00	3.00	12.00	1.00	13.00
Rail per ton	48	3½	7½	3½	15	7.20	200	.04	.01	.05	.00	.05
Track throwing machine	6,000	3½	12½	3½	20	1,200.00	200	6.00	2.00	8.00	1.00	9.00
20-yd. air dump cars	3,750	3½	12½	3½	20	750.00	200	3.75	.25	4.00	.25	4.25
16-yd. air dump cars	2,800	3½	12½	3½	20	560.00	200	2.80	.20	3.00	.25	3.25
12-yd. air dump cars	2,000	3½	12½	3½	20	400.00	200	2.00	.15	2.15	.15	2.30
4-yd. dump cars	430	3½	12½	3½	20	86.00	200	.43	.07	.50	.10	.60
1½-yd. dump cars	110	3½	12½	3½	20	22.00	200	.11	.09	.20	.10	.30
1-yd. dump cars	90	3½	12½	3½	20	18.00	200	.09	.06	.15	.10	.25
Flat cars	1,000	3½	7½	3½	15	150.00	200	.75	.15	.90	.10	1.00
Gasolinel ocomotive	3,200	3½	12½	3½	20	640.00	200	3.20	1.05	4.25	1.25	5.50
1-yd. Koppel cars, V shape	110	3½	12½	3½	20	22.00	200	.11	.04	.15	.05	.20
Motor truck, 5-ton	6,000	3½	22½	3½	30	1,800.00	200	9.00	7.50	16.50	5.00	21.50
Automobile	2,000	3½	31½	15	50	1,000.00	200	5.00	2.50	7.50	2.50	10.00
Caterpillar tractor gas	5,000	3½	12½	3½	20	1,000.00	150	6.66	8.34	15.00	5.00	20.00
Vertical boiler	900	3½	7½	3½	15	135.00	100	1.35	.65	2.00	.00	2.00
Locomotive boiler	1,500	3½	7½	3½	15	225.00	100	2.25	1.00	3.25	.00	3.25
Steam pump	500	3½	7½	3½	15	75.00	100	.75	.50	1.25	.00	1.25
Centrifugal pump, d. c.	1,500	3½	7½	3½	15	225.00	100	2.25	1.25	3.50	.50	4.00
Belted pump	300	3½	7½	3½	15	45.00	100	.45	.30	.75	.00	.75
Deep well pump	600	3½	7½	3½	15	90.00	100	.90	.60	1.50	.00	1.50
Gasolene engine	1,200	3½	7½	3½	15	180.00	100	1.80	.60	2.40	.10	2.50
Steam engine	1,800	3½	7½	3½	15	270.00	100	2.70	.90	3.60	.15	3.75
Hoisting engine	4,250	2½	7½	3½	15	637.50	100	6.38	2.12	8.50	.50	9.00
Horse pile driver	800	3½	12½	3½	20	160.00	100	1.60	.40	2.00	.00	2.00
Steam pile driver	2,000	3½	12½	3½	20	400.00	100	4.00	.75	4.75	.75	5.50
Track pile driver	10,000	3½	7½	3½	15	1,500.00	100	15.00	3.00	18.00	2.00	20.00
Steam pile hammer	2,500	3½	7½	3½	15	375.00	100	3.75	.75	4.50	.50	5.00
Air compressor	3,000	3½	7½	3½	15	450.00	100	4.50	1.50	6.00	.50	6.50
Electric motor	500	3½	12½	3½	20	100.00	100	1.00	.35	1.35	.15	1.50
Deep well drill	2,000	3½	12½	3½	20	400.00	100	4.00	.50	4.50	.50	5.00
Steam tripod drill	400	3½	12½	3½	20	80.00	100	.80	.20	1.00	.25	1.25
Jack hammer drill	140	3½	12½	3½	20	28.00	100	.28	.22	.50	.25	.75
Air steel sharpener	2,000	3½	12½	3½	20	400.00	100	4.00	.25	4.25	.25	4.50
Stiff leg derrick	2,000	3½	12½	3½	20	400.00	100	4.00	.50	4.50	.75	5.25
Forrest log loader	400	3½	12½	3½	20	80.00	100	.80	.20	1.00	.25	1.25
Lee wagon loader	225	3½	12½	3½	20	45.00	100	.45	.15	.60	.15	.75
Clam shell bucket	1,500	3½	12½	3½	20	300.00	100	3.00	.25	3.25	.25	3.50
Rock channeler machine	3,000	3½	12½	3½	20	600.00	100	6.00	2.00	8.00	1.00	9.00
Grading machine	1,350	3	23½	3½	30	405.00	150	2.70	1.30	4.00	1.00	5.00
Pony road grader	200	3	23½	3½	30	60.00	150	.40	.20	.60	.15	.75
Grading plow	30	3	23½	3½	30	9.00	150	.06	.04	.10	.00	.10
Dump wagon	180	3	23½	3½	30	54.00	150	.36	.34	.70	.15	.85
Hauling wagons	120	3	23½	3½	30	36.00	150	.24	.21	.45	.15	.60
Wheel scrapers	50	3	33½	3½	40	20.00	150	.13	.12	.25	.00	.25
Slip scrapers	8	3	43½	3½	50	4.00	150	.03	.02	.05	.00	.05
Fresno	22	3	43½	3½	50	11.00	150	.07	.08	.15	.00	.15
Switches complete	150	3½	7½	3½	15	22.50	200	.11	.02	.13	.00	.13
2-in. galv. pipe per 100 ft.	22	3½	7½	3½	15	3.30	200	.02	.01	.03	.00	.03
2½-in. galv. pipe per 100 ft.	34	3½	7½	3½	15	5.10	200	.03	.01	.04	.00	.04
3-in. galv. pipe per 100 ft.	45	3½	7½	3½	15	6.75	200	.04	.01	.05	.00	.05

daily of the equipment to the work, as his charges must also include the cost of field repairs in making up the tender. The values in this column are used in charging out rental also on work of such short duration that the wearing of parts designated as field repairs will not accrue during the interval of time during which work is being carried on, thereby preventing the intelligent charging of the field repairs directly against the work.

In cases where a contractor is executing unit price or lump sum work on which force account jobs come up, requiring the use of equipment for short intervals of time less than weeks, it is recommended that rental charges be made on a working day basis instead of the earning day basis shown in the table. In this manner the lost time, including holidays, during the earning time of the machine, will be taken care of. It will usually be found that an increase of 25 per cent on the total rental rate, including field repairs, will cover this condition.

Some contractors charge the equipment directly against the work at its value when going on the work and crediting the work with its salvage value on completion of the work. This method should never be used except on cost plus work, and then only when the equipment is disposed of immediately on completion of the job. In this manner the work will be made to stand the actual money cost of owning the equipment while on the work. In case the contractor takes the equipment over on completion of the work at its actual value, it is inevitable that there will be a loss to him as he has no way of collecting the accrued costs, such as interest, depreciation, etc., for the idle time between contracts. The only remedy the contractor would have would be to place a fictitious value on the plant and this is neither desirable nor conducive of good relations between the contractor and the engineer or proprietor, as the case may be. The writer believes that the only safe way is to charge rental against the work on a daily rental basis.

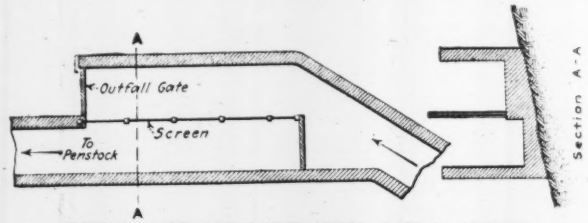
It should be kept in mind that all values shown in the table for equipment rental show actual costs and do not include any element of profit. Should the equipment be rented to outsiders, a profit should be added to the rates shown.

Flooding "Blisters" Granite Block Pavement

A considerable amount of granite block pavement was damaged through the breaking of a high-pressure water main at Walker and Baxter Sts., New York City. The break occurred in a granite block pavement laid on concrete in 1918, and the water made its way between the newly laid pavement and its concrete foundation on Walker St., from Baxter to Center, a distance of 190 ft. The result was that the granite paving was raised and left in blisters. These blisters rose as much as 2 ft. in some places and gradually sank until they rested on the earth washed in, leaving bumps from 3 in. to 6 in. in height. The granite pavement damaged was laid under the standard Manhattan specification, the filler being asphalt mixed with about an equal volume of hot sand and grouted into the joints with squeegees. The asphalt filler had a melting point between 115 deg. and 130 deg. F.; a penetration of 60 to 100 at 77 deg. F., and a ductility of at least 40 cm. at 77 deg. F.

Self-Cleaning Screen for Small Canals

A SCREEN that has worked successfully for [illegible] years, according to its owner, in keeping floating solids, leaves and other débris out of a small canal, is shown in the accompanying illustrations. The advantage

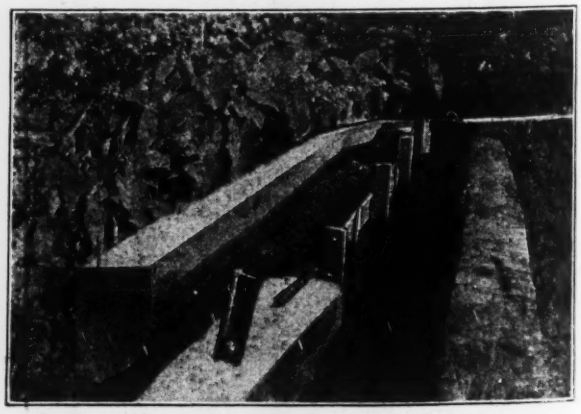


DETAILS OF SELF-CLEANING CANAL SCREEN

claimed for the design is that the screen cleans itself automatically whenever the outfall gate is opened to provide a free flow past the screen as well as through it. The outfall gate sill is not low enough to permit all the water to be diverted, so the operation of cleaning the screen does not shut off the water from the pen-

SCREEN IN OPERATION

stock below. Presumably, the gate at the upper end of the screen was put in so that the flow of water through the screen could be reversed. This has evidently not been necessary, however, for A. H. Green of Canefield, Dominica, B.W.I, who sent the foregoing information, states that this upper gate has never been opened since it was installed.



SCREEN BEING CLEANED

Bridge Piers Made From Old Boilers

PRESUMABLY after one of the stone abutments had been washed out, one end of the bridge shown by the accompanying view was provided with a new support consisting of two cylinder piers, each made from two old domestic boilers riveted together and filled with conrete.

For braces between the posts and cross-beams of the bridge, the woods were searched for trees with limbs at right angles with the trunks. These were then cut and hewn to shape. The bridge was located in Milton County, Georgia, a county only a few miles north of Atlanta but untraversed by a railway. A 40-ft. span concrete bridge has recently replaced the old wooden bridge. The new bridge was the first Federal-aid bridge to be built in Georgia. It was built under the direction of Arthur Pew, consulting engineer, Atlanta, Ga., acting for Johnson & Morgan.

STONE ABUTMENT REPLACED BY PIERS MADE FROM OLD DOMESTIC BOILERS FILLED WITH CONCRETE

Cracks in Rail Steel Correlated with Fissure Defects

Fine Cracks Located by Deposit of Iron Dust From Oil Emulsion on Magnetized Piece Later Brought Out by Deep Etching

SIGNIFICANT indications tending to prove that transverse fissures in steel rails start from minute interior cracks have been discovered by Henry S. Rawdon, associate physicist, Bureau of Standards, in an investigation whose results are made public by the American Railway Engineering Association in a report of its rail committee, just issued. A method was perfected by which exceedingly fine cracks, not detectable by ordinary means (even high-power microscopic examination of a polished surface failing to locate them) were revealed on the surfaces of slices of rail steel without requiring the specimens to be destroyed or injured. Subsequent "deep etching" according to the procedure developed last year by Waring and Hofammann transformed such cracks into deep narrow gashes like those produced in typical steel from transverse-fissure rails in the numerous studies of such rails made during the past year. While the results hardly constitute final proof, they establish a very strong probability that the initial defects responsible for transverse fissures are very fine cracks existing in the steel before it is placed in service.

The essential studies were made on specimens from three rails which had developed fissures in the track. Horizontal slices from the heads of these rails showed no indication of defects when examined under the microscope. Then application was made of a magnetic method developed at the Bureau for inspecting gages: "The specimen, which must be polished on the surface as for microscopic examination, is magnetized and then immersed in kerosene or a similar liquid containing very fine iron dust in suspension. Cast-iron mud from disks used for lapping operations is admirable for the purpose. Particles of the iron dust collect upon the polished face of the magnetized specimen, and at the places where, because of a discontinuity within the metal, a change in the density of the magnetic flux occurs, orient themselves to correspond to the shape of the discontinuity. The specimens are finally washed in clean kerosene to remove as much as possible of the excess iron dust which is scattered over the surface." Applying this method to the rail specimens there were outlined in each, quite clearly, numerous lines (cracks) of greater or less length. Oblique illumination made them more clearly visible. Wiping off the iron dust and repeating the process gave the same results, just as definitely. Then the locations of the cracks were marked on the specimen, and by means of this orientation, after the specimens were wiped clean the defects were examined under the microscope, both before etching and after etching with 2 per cent alcoholic nitric acid (light micrographic etching). The etched specimens, even under a magnification of 500, gave only the faintest indication of cracks, an indication that would doubtless have been overlooked or interpreted in another way had the presence of the cracks not been known from the magnetic method. Finally, the specimens were etched deeply by immersion for some hours in hot hydrochloric acid. This operation developed at each of the cracks which the magnetic method had detected a deep gash of the kind known from previous deep-etching studies.

Following this clear-cut correlation between cracks and fissure defects—the gashes produced by deep etching having been pretty definitely correlated with actual transverse fissures by previous studies—one of the rail specimens was cut into strips, each including within its

width a crack located magnetically, this crack being transverse to the strip. On breaking the strip, the fracture face showed a spot, corresponding to the crack, identical in appearance with those seen at the center of a transverse fissure, and with the "gray spots" often found in defective rails.

More definite proof that the faint lines revealed by the magnetic methods are cracks was given by a specimen in which a punch mark was made at each end of one of the lines traced out by the iron dust, so as to wedge apart the crack if it was a crack. Microscopic examination now showed the crack very distinctly as such.

On one of the rail specimens, in which the carbon content was low enough so that the grain boundaries were clearly outlined by ferrite envelopes, one of the magnetically located cracks was studied under the microscope after slightly enlarging it by etching it with concentrated hydrochloric acid. It was then seen that the crack passed through the grains and not along the grain boundaries. A crack found in a forging for a gun tube, however, was seen to be intercrystalline, that is, it passed along the grain boundaries. Mr. Rawdon concludes that this latter crack probably originated when the specimen was at high temperature, while the cracks in the rail steel were probably formed when the metal was cold.

Engineering Aspects of Stump Removal from Land

Machines and Explosives Are Available, but the Former Need Improvement—Millions of Acres Await Clearing

DEVELOPMENT of improved machinery and methods for the removal of tree stumps in order to open cut-over lands for cultivation is highly desirable for economic reasons in view of the great area of land to be cleared, but as yet there has been only a limited application of engineering skill and the methods now in use are not far different from those of early days. These were the basic ideas of a paper read late December, 1919, at the annual meeting of the American Society of Agricultural Engineers, in Chicago, by John Swenehart, in charge of land clearing investigations that have been conducted during the past two years at the College of Agriculture, University of Wisconsin.

He pointed out that in Wisconsin alone there are 10,000,000 acres of usable cut-over land averaging 60 stumps per acre, with a total of some 600,000,000 stumps to be removed. It is true that machines have been devised and explosives utilized, but their use is relatively limited and few of the numerous patents contain any practical ideas. Furthermore, says Mr. Swenehart, there are no contractors able to figure on such work and to carry it out, although in many cases it must be done on a large scale.

From the engineer's standpoint there are numerous factors to be considered in determining the methods and cost of stump removal. These include the soil, moisture conditions, kind of tree, character of roots and the size and age of stump. The water level has considerable influence upon the root system and upon the degree of difficulty in breaking the stump loose from its anchors. While a maple stump is hard to remove when green, its top and small roots will have rotted in a few years so that a light charge of dynamite will suffice for a large stump. On the other hand, a white-pine stump ten years old will be in good condition owing to its resinous content and even 60-year old stumps of this kind may be difficult problems.

Explosive force, mechanical power and animal power are available. In their application the speed of operation and the strength of materials are two important considerations, while the stacking of the removed stumps must be included. Experiments have been made in promoting decay by the application of chemicals, but these do not promise practical results.

Investigation with explosives has shown the desirability of using those which produce a slow heaving action rather than a quick shattering action. Dynamites composed chiefly of nitroglycerin and having the remainder of their content mostly of ammonia or sodium nitrate or other active basic materials which are themselves explosives, are gaining in use as they are safer, slower in action, less affected by freezing and produce less poisonous effects to the user than other dynamites. Old practice called for high-grade or shattering explosives, but the lower grades, with slower action, are equally, if not more, efficient with a reduction of 20% to 25% in cost.

In spite of reports of the terrific action of trinitrotoluene (T.N.T.) this has been found a very desirable explosive when used in small charges, as in land clearing. Where quantities of over 50 tons are required it would replace dynamite at equal price. Mr. Swenehart points out, however, that under present market and industrial conditions T.N.T. cannot be manufactured to compete with dynamite, but that on the other hand there is use for all the war salvage T.N.T. that can be obtained. More publicity should be given to electric blasting, as preferable to the cap and fuse method. Mud capping is applicable for splitting stumps. Depth of hole and proper tamping are important factors in getting efficient results.

Trial of machines on actual work has developed certain weak points in both engine-operated and horse-operated apparatus. A suitable machine must be simple, light in weight and of low price. In Mr. Swenehart's opinion it must develop both strength and reasonable speed on the pulling line, although where great strength is required the speed will be at a minimum. For old tough stumps a combination of stump puller and explosive is effective. In any case, the power machinery should include means for piling the stumps.

Engineering Students at University of Illinois

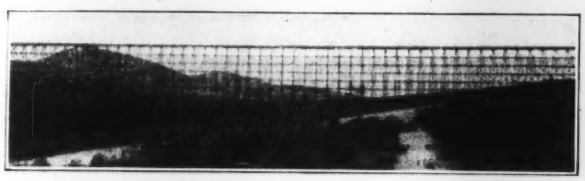
According to announcement from the University of Illinois, the number of engineering students Oct. 1 was very nearly 1700, or fully 50% more than the normal number for the past decade, and far more than had been anticipated. A little less than one-half—or, in round numbers, 750—are freshmen. The large freshman attendance is probably accounted for by the fact that it includes practically three years' accumulation, as many of these men would have entered in 1917 or 1918 had it not been for the war. Another cause for the large attendance is that Illinois does not discriminate against students from outside the state and has not raised the tuition or entrance fees. There is practically no cost to the students beyond board and lodging, except the $15 incidental fee for each semester.

Life of Flume Prolonged by Roofing Paper Lining

After Other Means of Stopping a 50% Leakage Had Failed the Paper Lining Kept the Leakage Below 10% for Five Years

A WOODEN flume that has now supplied a Southern California irrigation district for over 30 years began to leak badly a few years ago. The leakage increased despite remedial measures, until about 50% of the flow was escaping. The water company was losing revenue and there was danger of crop loss through water shortage, so immediate relief was necessary. On account of the high cost of permanent flume construction and the improbability of earning a return on investment of that sort, effort was made to find some cheap and effective means of reducing leakage in the old flume. Various expedients had been tried before this time. Sections of the flume box had been caulked and battened, or coated with hot asphalt, a layer of burlap applied, and a second coat of asphalt put on over the burlap. None of these expedients, however, reduced the leakage materially.

It was finally decided to try lining the flume with prepared roofing paper. Three methods were worked out and careful records of each were kept. The more effective of these reduced the leakage from 50% to



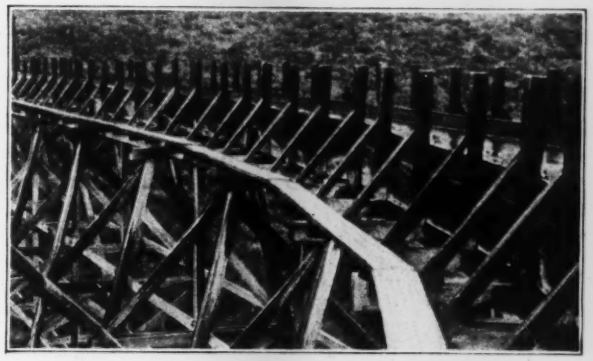
PART OF 30-MILE FLUME WHOSE LIFE WAS PROLONGED 5 YEARS BY FELT LINING

about 3%. After five years of service the leakage is still kept down to about 10% by the occasional renewal of sections here and there.

Of the three types of lining tried, one was effective but cost too much, another was entirely unsatisfactory and after being in use for about two years was removed and replaced by a third type which was found to be entirely satisfactory and was adopted as standard. An advantage claimed for lining of the roofing paper type is the ease with which repairs or renewals are made. In addition to maintenance of this sort it has been found desirable to mop the entire lining with asphalt at intervals of at least two years.

Three Types of Lining

In the Type I lining the flume was strengthened wherever necessary, large cracks were plugged, flume box was swept and seams were mopped with asphalt. All this was done by company force. Contractors then flooded flume with hot asphalt, into which a layer of "P & B" asphalt saturated felt weighing 11 lb. per square was placed while the asphalt was still hot. The felt was lapped 3 in. at seams, and was reinforced in corners and at all joints with strips of Irish felt. The felt was then flooded with hot asphalt and 1-ply "Tronolite" roofing, weighing 37 lb. per square, was



SHOWING HOW LINING WAS TACKED ON INSIDE OF FLUME

applied while asphalt was still hot. The lining was then mopped with hot asphalt. A total of 140,940 square feet of flume was lined in this way.

In the Type II lining the flume was prepared by the company's men as above. By mopping on hot asphalt the contractor then attached a strip of water proof felt to the flume box where the roofing paper joints would come. After mopping this felt strip one edge of the roofing sheet was nailed down to it and when the sheet had in turn been mopped the edge of the overlapping sheet was placed and nailed every two inches. Finally, the joint was mopped over the nail heads. The upper edge of the roofing on the sides of the flume was nailed without mopping. Two-ply Trino ready roofing was used in this type on 189,560 sq.ft. of flume. At least 35 lb. of asphalt per square was found to be desirable with this type.

In Type III the flume was prepared for lining by the company's men as already described. The contractor coated both flume and lining with hot asphalt and applied the lining while the asphalt was still hot, thus forming a tight bond between lining and flume box. Laps in the lining at joints were nailed with large flat-headed, roofing nails. A total of 1,051,402 sq.ft. of flume was lined in this way, using 2-ply Flaxine and Argonaut prepared roofing.

Costs

The cost of preparing the flume for lining, hauling materials, supervision, etc., was $7,838.62, or $0.57 per square. This charge was made against all types of lining. California asphalt was used throughout. The costs were as follows:

Type I	
Preparing flume, etc., 1409.4 squares at $0.57	$799.67
Lining by contract, 1409.4 squares at $3.43	4,831.30
1409.4 squares at $4	$5,630.97
Type II	
Preparing flume, etc., 1895.6 squares at $0.57	$1,075.49
Lining by contract, 1895.6 squares at $2.47	4,678.07
1895.6 squares at $3.04	$5,763.56
Type III	
Preparing flume, etc., 10,514 squares at $0.57	$5,963.46
Lining by contract, 10,514 squares at $2.43	25,541.44
10,514 squares at $3	$31,504.90
Total: 13,819 squares at $3.10	$42,889.43

The flume is owned by the Cuyamaca Water Company of San Diego County, of which Col. Ed. Fletcher is general manager. C. Harritt, superintendent, had charge of the experimental and maintenance work in lining the flume.

What Risks Should Cities Take in Installing Relatively Untried Processes?

Opinions by Consulting Engineers, Municipal Engineers and Engineers of State Departments of Health on Question Raised Editorially in "Engineering News-Record," Nov. 27-Dec. 4, 1919, with Particular Reference to Drifting Sand Filters and the Electrolytic Process of Sewage Treatment

MORRIS KNOWLES
Consulting Engineer, Pittsburgh, Pa.

I am glad that *Engineering News-Record* has called attention to the risks incident to installing processes or devices of an engineering nature still in the development stage. It is my opinion that a city may properly incur the expense of establishing experimental stations for the purpose of studying untried processes which promise returns sufficient to justify the expense. In fact, engineers employed by public agencies should encourage every such project which indicates the possibility of a real contribution to the advance of the art in question, and to the fund of engineering knowledge. I agree that "no material risk of this kind should be taken by the city without the approval of a competent, disinterested engineer." I am not prepared, however, to state that such was the situation at Toronto, for I have always understood that such experimentation was carried out under the supervision of the advised municipal authorities.

JOHN W. ALVORD
Consulting Engineer, New York City

I think that it is improper for the consulting engineer to recommend to a city any very large-sized construction based on novel or experimental processes. Desirable as these may appear for the moment, and as anxious as the engineer may be to keep up to date, it is nevertheless the part of wisdom to go slowly. It would be better, in my opinion, to postpone improvements, if possible, rather than to branch off of the beaten path in the hope of success along new and untried lines.

Sewage treatment is in my mind, particularly at this time, a branch of the engineer's work which has in the past suffered from too keen a desire to develop processes and methods which were at the time of their introduction not well demonstrated. At the same time, I believe that the engineer should be progressive enough, especially along lines which he has thoroughly mastered, to be in the habit of introducing minor experimental features in his designs, as this is about the only way in which engineers can make any progress that is worth while. One should be careful, however, to make such minor experiments in the most conservative way, planning them so that if they do not develop as anticipated they can be easily remodeled, if not successful, or can serve, without remodeling, well-known and well-tried methods.

METCALF & EDDY
Consulting Engineers, New York City

We were much interested in your discussion of the extent to which cities are justified in taking risks incident to the adoption of processes or devices still in the experimental stage.

Broadly speaking, the goal sought is that the city should secure that process and equipment which will accomplish what is necessary at the least cost. No one process or equipment should be adopted until it has been demonstrated to the satisfaction of a competent, disinterested engineer, skilled in the particular field of engineering under consideration, that it can accomplish the work desired of it, at an advantageous cost.

A large municipality is generally justified in taking the time and expending such moneys as may be necessary to thoroughly investigate available processes which give sufficient promise of meeting the two requirements above mentioned; but the determination of the fact that the process does or does not give such promise should be decided by a competent, disinterested engineer or board of engineers. Such investigations may well include experiments and, if practicable, a demonstration of the capabilities of the processes, for a period of time long enough to make the results reliable and conclusive and of such scope as to give adequate basis for the design of the new plant. A process which cannot be justified in this manner, should not be adopted.

It has sometimes been suggested that experiments and a demonstration be conducted for a definite period of time, such as one year, and that the city might well expend a sum equivalent to the interest for that period, on the investment required to install the plant. In some cases a longer period of time has been required for preliminary investigation, and the increase in expense thus involved has been justified either by the greater ultimate assurance of success resulting from the more adequate determination of the basis for design, or by preventing the loss which would have been involved by the adoption of an unsuccessful process.

It is to be noted, however, the large municipality can generally afford to go much further in its detailed investigations than can the small one. Similarly, the larger community can afford to adopt more highly complex methods of doing the work, because of the greater saving in investment which will thus result to it, than can the small community, to which the securing of competent service to operate such works might become a serious financial burden. This makes the more necessary the advice of a disinterested engineer, not only skilled in the technique of the work, but also one having financial grasp and ability to see whether or not the community is justified in making large expenditures for the particular work under consideration, in the face of its other municipal needs.

EDWARD A. WALL
Water Commissioner, St. Louis, Mo.

There are occasions when circumstances justify a municipality in experimenting with and developing machinery or processes intended to increase economy of operation or to produce improved conditions.

Such circumstances are not unusual as occurring in minor matters, where failure does not mean serious financial loss and where no great expenditure is involved. In fact, municipal departments are continually

experimenting with new devices and methods, usually originated or suggested by their own employees. This, however, is a very different matter from backing an original venture designed to introduce a decided innovation.

In those cases where no practical solution has been found and where no satisfactory process has been developed, nor its character even indicated by the work done and the knowledge obtained, the municipality can very properly undertake pioneer work for its own advantage. The question of when a city or town should take such a risk thus becomes a matter of judgment in each case. If the final results prove satisfactory and show that the money was well spent, then the officials authorizing the expenditure showed good judgment, but if the scheme fails, the contrary is the case.

Not only every municipality but also every large corporation has in its history the record of many failures, mostly small, but here and there one large enough to command more than local attention. So long as human nature retains its propensity to gamble, both municipalities and individuals will delight in taking chances.

CHARLES E. GREGORY

Deputy Chief Engineer, North Jersey District Water-Supply Commission; formerly Engineer of Sewers, Borough of Manhattan, New York City

Your discussion of the Toronto experiment with "drifting-sand filters" and the proposed installations of the "direct-oxidation process" of sewage treatment is most timely and should be brought to the attention of all city officials who are contemplating the construction of large purification or other public works.

The officials intrusted by municipalities with the responsibility of deciding policies of sewage or water purification are usually non-technical men who must reach a conclusion based upon the evidence and opinions of others, and under certain conditions it is quite normal for them to be influenced very strongly by the well organized propaganda of salesmen or promoters who advocate the installation of patented or privately controlled processes or devices. These salesmen or promoters are not retarded in their efforts by professional ethics or the lack of financial support which is necessary to meet the legitimate expenses of any long-drawn-out controversy over a policy to be adopted, and the warning which you make against arriving at a decision without the support of the opinion of an unbiased and disinterested competent, technical adviser is so important that it should, I believe, be given publicity in the non-technical press and especially in all periodicals which reach responsible city officials.

The writer has had the opportunity to observe how the claims of the promoters appealed to responsible officials in New York City and how, upon the completion of a careful scientific investigation, these claims were almost wholly disproved. One of the common methods employed by promoters in matters of this kind is to pick out a novel feature of a process and unduly emphasize its function and importance, thus often leading to a conclusion which could not have been reached had all the elements of the case been given their due weight.

I believe the controversy about the real efficiency of the electrolytic process for treating sewage affords a good example of how the suitability of a system of treatment can be misunderstood by laymen and even by technical men not intimately familiar with sewage treatment. The award by the Franklin Institute of the Howard N. Potts Gold Medal to C. P. Landreth for his electrolytic sewage process seems to have been based very largely on the fact that a new element, the use of the electric current, had been added to the old and largely discarded chemical precipitation process even though such addition did not very materially change the results obtained by the older methods alone. To the layman, electricity is a sort of Aladdin lamp which may be expected to accomplish results such as the writer of any fairy story might imagine, and I believe this attitude has had much to do with the more or less successful promotion of electrolytic processes.

Before the experiments at Elmhurst (Borough of Queens, New York City) were made very extravagant claims were put out by the promoters who were then exploiting the Landreth process. These claims had to do with both costs and results. Practically none of the cost claims were verified and while a satisfactory effluent was obtained it was not materially better or different than could have been obtained by less expensive and better understood methods.

The direct oxidation of organic matter in sewage has been a subject for experimentation for a long time. The earlier experiments in aëration which indicated beneficial results were believed by some to be due to direct oxidation. Since then the development of the activated-sludge process has shown that the beneficial results obtained were probably almost wholly due to the action of aërobic bacteria rather than direct oxidation. It is probably true that the dissolved oxygen content of sewage is increased by the electrolytic process and that there is probably some small degree of direct oxidation, but it is not likely that the organic matter in the sewage, especially that in the form of suspended solids, would be broken up and oxidized in any appreciable quantity by the free oxygen liberated through the action of the electric current. The treatment of sewage by ozone has been repeatedly tried without satisfactory results, and even if direct oxidation were a practical method it has not been shown that the Landreth electrolytic process is the cheapest method of obtaining the free oxygen.

Sludge disposal is one of the most difficult and expensive elements of sewage treatment, and the large quantity of sludge to be cared for from the old chemical precipitation process was one of the strongest reasons for its unpopularity, whereas one of the strongest claims for favor put forth by the Imhoff tank is the small volume of inoffensive sludge. The lime-electrolytic process is no improvement in this respect on the older chemical precipitation processes.

The lime-electrolytic process, even if the more recent claims of the owners are admitted, does not promise greater efficiency, reliability or economy than other and better established processes, and while someone must "take steps in the dark" those who are to take them should be sure that they are toward something better and that the advantage to be gained is commensurate with the risk taken.

W. H. DITTOE

Chief Engineer, Ohio State Department of Health, Columbus, Ohio

Before a municipality adopts a method of water or sewage treatment, it is the duty of its officials to become reasonably certain of its applicability, efficiency, and economy of the method. As the layman is rarely, if

ever, able to make such a decision, the advice of a competent and disinterested engineer is always necessary, and in case the method under consideration is a new one, and without good precedent, careful experimentation, testing and demonstration on a small scale are demanded. Such studies should be under the direction of a disinterested consulting engineer, or, in case of large projects, a board of consulting engineers, whose conclusions should determine the action of the municipal officials. No municipal governing body has the right to "take a chance" by proceeding without such care, regardless of individual opinions or preferences. Of course, we cannot expect the development of new methods and of improvements in established methods unless some municipality takes the lead in trying them out, but we can and should expect such municipality to be guided by established principles, precedents, if any exist, and, above all, by sound engineering advice.

J. W. EVANS
Engineer, Oklahoma State Department of Health, Oklahoma City

Your timely editorial on the risks taken by municipalities in installing public works should receive the careful attention not only of engineers but of all municipal officials. Just at present the cost of improvements is so great that mistakes which involve unwise or unnecessary expenditure in first cost or maintenance result in the omission of other needed public works. To stake large sums of the taxpayers' money on the success of a device which is experimental is therefore economically unjustifiable.

Reference has been made to the decision of two eastern cities to construct sewage-treatment plants involving the electrolytic process. This decision appears little short of folly in view of the fact that this process is still in the experimental stage, and that investigations heretofore made public have shown that the cost of sewage treatment by this method is much greater than by other processes. To Oklahoma engineers especially the expenditure of funds for electrolytic sewage treatment seems ill-advised because six plants of that type have been abandoned here and the seventh is off duty most of the time. [See p. 135 of this issue for reprint of a report by Mr. Evans.—Editor.]

The desire on the part of municipal officials to try something new is evidenced by a certain city of 2,500 in this State where an activated-sludge plant was built two years before the sewer system was placed in operation and while the city was without water. This plant is not provided with any means whatever for disposing of the sludge.

Too often city officials render themselves liable to criticism at the taxpayers' expense. In the words of one observer, "the officials are prone to have their engineering done by salesmen and manufacturing companies rather than by engineers whose judgment is less likely to be affected by a desire to market their equipment."

THEODORE HORTON
Chief Engineer, New York State Department of Health, Albany, N. Y.

The question, what risks a city should take in adopting new processes, is a very pertinent one. To see it in proper perspective, one must realize that no great advancement in any field can take place without experiments on a large scale. Just how far a state department having jurisdiction over cities should permit them to experiment with new or untried methods or whether it should permit them to experiment at all, is, I presume, the question at issue.

My personal opinion is that if a municipality is fully advised as to the experimental nature of any new and untried project which it contemplates installing, the State Department is thoroughly justified in approving the plans if it thinks the experiment will prove successful. If, on the other hand, the State Department feels that the proposition is too experimental in nature, and there is any indication that it may prove a failure, I think the department is justified in disapproving it. In other words, I believe in allowing the municipality to use its own discretion in carrying out a plan which is experimental, providing the State Department feels that there is a strong probability that the works will prove effective—particularly if, as in New York State, the approval is based upon conditions that the plant must be successful or else so changed as to make it so. We find many municipalities that are thoroughly aware of the experimental nature of the plans which are presented to the State Department of Health by them and who are willing to take the responsibility for the success of the plans; and wherever I am convinced that the plans will probably work effectively, even though the plans may not be the best, I usually recommend approval of them.

In large experimental plants, like the drifting-sand filters, which have never been tried out, I usually do not recommend the approval of plans unless accompanied by experimental results on a smaller scale to justify my belief that the larger scale experiment will work, or unless the municipality can point to some plant, large or small, which is in actual operation and from which the data concerning its success can be obtained upon investigation. Personally, I am rather inclined to err on the side of approving experimental works on a large scale, giving the benefit of the doubt to the municipality in its desire to experiment, where I am reasonably satisfied that the experiment will prove successful, since I believe that progress in these fields is only made by full-sized experimental plants. In all such undertakings, however, I always advise that it is much better for the city to experiment on a full-sized unit before rushing to put in a large plant containing a great many units, and to determine the success of the single unit before making expenditures for the complete plant.

Conversely, I would point out that there are some types of plants both in the water-supply and sewage disposal field which are considered experimental and in the development stage, where, however, the fundamental factors in regard to them are well known and established and particularly in regard to defects and excessive cost. I do not believe that the State Department is justified in approving a plant of such a type, for in this case the department would know of the obvious and insurmountable defects and objectionable features and would have knowledge that there are other types of recognized superiority which would accomplish better results at less cost. Where such plants are under consideration and such definite knowledge exists, the State Department might feel justified, and perhaps be justified, in disapproving the plans.

There is some question as to the legality of disapproving plans which may produce effective results not-

withstanding the apparent relative inefficiency and lack of economy of the apparatus and methods. In other words, if one of these semi-experimental plants, not fully developed, will produce results which are satisfactory and meet the fundamental requirements of the State Department in regard to effluents or in regard to stream pollution, it is a question whether the State Department would have the legal right to disapprove the plans notwithstanding the relative lack of efficiency or economy of the apparatus proposed.

Finally, I feel that there is no hard and fast rule that can be applied to a question of this kind. The complexity of factors, engineering, economic, legal and administrative, do not permit of such formulation. I am pleased, however, to express my personal views on the subject so far as they can be expressed within these limitations.

Idle Electrolytic Sewage-Works in Oklahoma

Only One of Seven Plants Built Now in Use—Official Report by J. A. Evans, Engineer State Department of Public Health

THE prominence which has been given by recent engineering periodicals to a discussion of the electrolytic process of sewage disposal justifies a review of the experience obtained by Oklahoma municipalities with plants of that type.

The seven electrolytic disposal plants in Oklahoma were constructed during the years 1913 to 1915, prior to the operation of the present law requiring approval by the State Department of Public Health. The popularity of the process may have been traceable to overzealous salesmanship, the common belief that electricity could be made to perform any feat, and a desire on the part of engineers to test on a practical scale a new process of sewage disposal. That this popularity was brief is evidenced by the fact that of the seven plants only one is now operating, and that during but eight hours per day.

An electrolytic plant for treating sewage usually includes a preliminary settling tank, troughs through which the settled sewage flows longitudinally between thin metal plates, motor generator sets for production of direct current, wiring between generator and plates so arranged that current passes from plate to plate through the sewage. The purification is probably effected by chlorine and hydroxides which are produced by the action of electric current on the sewage. In the Oklahoma plants no attempt has been made to use lime or other chemicals. The following brief description shows what conditions the plants in Oklahoma were expected to meet and what results were obtained.

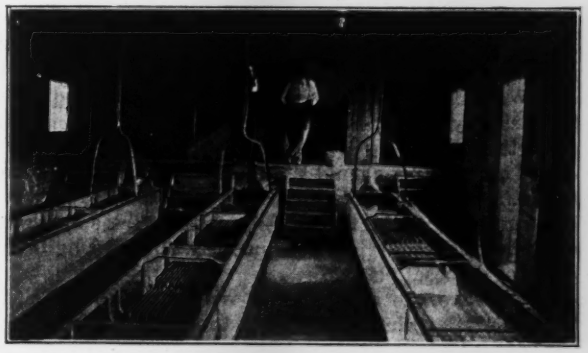
At Oklahoma City two plants were built, one to treat packinghouse wastes after screening and settling, and the other to treat domestic sewage after passage through a septic tank. For about eighteen months an attempt was made to operate the former plant. The difficulties encountered in disposing of solids, keeping plates clean, and broken parts replaced, combined with the fact that a thorough test made by B. M. Hart, city engineer, showed no appreciable purification, caused the abandonment of this plant. The other plant, treating domestic sewage, was abandoned after five years' service. No records are available showing that any purification was effected by this plant, but the residents along the stream into which the sewage discharges make great claims for it. However, it is believed that much of the purification noticed was accomplished by the septic tank, which has not been cared for since the abandonment of the electrical equipment. The plant is equipped with two 20-hp. motor generator sets, four troughs, 18 x 24 in. x 42 ft., each trough having 13 sets, 29 plates, 12 x 24 x ¼ in., placed ½ in. apart. The area supplying this plant is a residential section of ten thousand people.

At Duncan, a city of about 2,500, a plant was built in 1913 consisting of a small receiving tank, a centrifugal pump lifting sewage from the bottom of the tank, electrolytic troughs and motor generator sets. This plant was abandoned after five years' service because of the high expense for repairs and because skilled attendants were not available.

The Dewey plant was shut down after six years' operation because the plates were worn out.

At Henryetta the electrolytic process was abandoned in 1917 after four years' service. The operator states that its use was discontinued because tests failed to show that any good results were being obtained.

At Coalgate a plant was built in 1914 and never used. This plant included a receiving tank for storing the sewage, a centrifugal pump delivering to troughs and the usual arrangement of plates. No direct-current



TROUGH ROOM OF ELECTROLYTIC SEWAGE-TREATMENT PLANT AT DURANT, OKLAHOMA

machine was provided with the equipment, and the city found, after constructing a power line to operate the pump, that the motor was not designed for city current.

The Durant electrolytic plant, which is still being operated during a portion of the day, includes a modified Imhoff tank, distributing tank, three troughs and three motor-generator sets. Current is being applied at 160 amp. and 4 volts. Only one trough is now being used, the clarified sewage being retained in this trough three to five minutes. The operator devotes a part of his time to an incinerator which is located near by, and the necessity for his presence at the incinerator probably explains why the electrolytic plant is still operated.

It is impossible to obtain any accurate data of cost of operation of the electrolytic plants in this State because not one of them is being satisfactorily operated. The failure of these plants in Oklahoma is traceable in part to neglect by the builders to properly instruct the municipalities in caring for the equipment. At several plants an attempt was apparently made to obliterate all traces of the whereabouts of the manufacturers, no plans or directions being left and all nameplates being removed from motors and other parts. However, the

entire blame for failure does not attach to the process nor to the builders, because the municipal governments have usually made but half-hearted efforts to get results.

A ten-day test was made in September and October, 1914, of the Durant electrolytic plant by J. E. Welker, then assistant engineer for the Kansas State Board of Health. (See *Engineering News*, Sept. 21, 1916, p. 547.) His conclusion, based on a great many bacterial and putrescibility examinations of samples taken at various stages of the process is in part: "As a result of the experimental data, three main points are brought into evidence: (1) Deodorization of sewage; (2) high stability of effluent; (3) variation in bacterial reduction."

Another test was conducted during August and September of the same year by Louis A. Turley, then state bacteriologist of Oklahoma. The results obtained by him showed a higher bacterial reduction and lower putrescibility values than were obtained by Mr. Welker. Mr. Turley concludes that "if the treatment is adapted to the character of the sewage an effluent will be obtained stable in character and with a bacterial content reduced to a minimum."

Samples from the Durant plant analyzed Nov. 21, 1919, by the Oklahoma State Health Laboratory gave the following bacterial count: Average of four samples from entrance to trough, 955,000 per c.c.; average of six samples from outlet to trough, 889,000 per c.c.

From an inspection of the electrolytic disposal plants in this State and a study of the test data available it is concluded that:

1. With skilled attendance and properly designed units the electrolytic process can be made an effective means of further purifying settled sewage.

2. This process should not be installed in municipal plants in Oklahoma because results equivalent to the best that can be produced by the electrolytic process are more easily, economically and continuously obtained by other types of disposal plant.

3. The average municipality will not give sufficient attention to an electrolytic plant to justify the expenditure of an installation.

Progress on the Teel Irrigation Project

PROGRESS on the 2½-mile rock tunnel for the Teel Irrigation District in Umatilla County, Oregon, has reached 18 ft. per heading per day. The tunnel will divert water from the John Day River watershed to that of the Umatilla River. It will be fed by a 17-mile collecting canal, tapping Camas, Hidaway and Cable Creeks. From the tunnel the water will flow through the natural channel of Butter Creek for 35 miles to a point where it will be diverted and distributed. The lands to be irrigated lie at El. 600 to 900 ft. above sea level in the neighborhood of Echo, Ore.

In addition to the tunnel and main canal there will be diversion dams, sidehill flumes, trestle flumes, inverted siphons, concrete drops and chutes, cement-lined ditches and other special construction works. A sawmill plant with an output capacity of 30,000 ft. b.m. daily has been installed on Camas Creek.

The tunnel is 12,341 ft. long, 8 ft. wide and 7 ft. high in the clear, with an arched roof. Its grade is 0.5% and the greatest depth below the surface is 640 ft. At each end is a plant with 190-hp. boilers and engines driving 10 x 12-in. compressors. A 50-in. fan draws the smoke and foul air from the face of the tunnel through an 18-in. pipe, so that the muckers are usually at work in from 3 to 5 minutes after a blast has been fired.

At each tunnel face are two air drills mounted side by side on a horizontal bar. Three 8-hour shifts are worked at each end of the tunnel, with two drillers and three muckers. They average 6 ft. per shift or 18 ft. per day, except that where timbering is required the progress is from 10 to 12 ft. per day. The rock is basalt, more or less broken at the beginning but becoming harder as the work progresses.

About 1¼ miles of excavation will be required for the main canal, about one mile of this being in solid rock and the remainder in a heavy black clayey loam. The bottom width is 25 ft. with side slopes of 1 on 1. This excavation is being done at the rate of about 1,000 cu.yd. per day by a caterpillar-mounted steam shovel, having a 1½-yd. bucket. About a mile of canal had been excavated by the middle of November.

The diversion dam is of timber, rock and earth, 195 ft. long, with an overflow crest or spillway 155 ft. long. An abutment connects it with the wall of the canyon at the east end while a combination headgate and abutment connects it with the canal at the west end. There are four controlling gates in the dam.

Construction work was commenced about Sept. 1. It is expected that excavation will be continued during the winter, but the flumes and trestles will not be started until spring, the main canal being at about El. 3,600 ft. W. B. Hinkle, consulting engineer, Echo, Ore., is engineer-in-chief for the Teel Irrigation District.

French Reconstruction Progress

According to a report from Paris written by Consul-General A. M. Thackara, and published in a recent issue of *Commerce Reports*, the Nord and the Est, the two principal French railroads suffering the most during the war, have been almost entirely reconstructed. It is predicted that a resumption of normal traffic will be possible in a few months.

On the line of the Nord but 1 kilometer or ⅝ mile of double track remains to be repaired, and this is over bridges in the course of reconstruction. The number of kilometers of double track not yet in service has been reduced to 15 kilometers and of single track 12 kilometers; these are short lengths approaching important bridges under reconstruction. All stations along the line of the Nord are in service. During October, 49 brigdes and viaducts were completed, bringing the total definitely completed to 256 out of 601. The reconstruction of the remainder is being carried on normally, the chief difficulties being inability of the French metallurgical industry to deliver quickly, and inability to secure structural steel in France on short order.

At the time of the signing of the armistice the length of double track to be repaired on the Est railroad amounted to 577 miles of double track and 126 miles of single track. Of these by November, 1919, 519 miles of double and 122 miles of single track have been repaired, leaving but 58 miles of double and 4 miles of single track to be completed. By the end of November but 20 miles remained to be reconstructed. Forty-six out of a total of 214 bridges have been definitely finished.

What Is the Future of Inland Water Transportation?—*Part III*

By Charles Whiting Baker
Consulting Editor, Engineering News-Record

The Ohio River and the Erie Canal are two inland waterways most favorably located to attract a heavy volume of traffic. The Government is spending about $100,000,000 on the Ohio River. The State of New York has spent $150,000,000 in the past 20 years on the improvement of the Erie and other state canals. The Erie Canal is practically completed. The Ohio River work is completed from Pittsburgh downstream two-thirds of the distance to Cairo. The Ohio River improvement, when completed, will cost the taxpayer's in interest, depreciation and operating expenses about $2,500,000 per annum. It will have to save at least that amount in reduced cost of carrying by water instead of by rail to make the work justifiable. The present traffic on the Ohio is small and the prospects for a large increase are not encouraging.

The traffic on the New York State canals has decreased one-half in the past six years, and two-thirds of that remaining is sand, gravel, stone and low-grade bulk freight. This season the Erie Canal carried only 300,000 tons of merchandise freight, and it cost the state's taxpayers over $20 for every ton of such freight moved. Few new boats are being built, for there is not profit enough in boat operation to attract capital.

VII—Continued from page 89

Traffic on the Ohio River

A method of transportation on inland waters of much lower cost than by steamboat is transport by barges, several of which are propelled by one power vessel. In the lake traffic the use of towed barges has been an important factor in reducing the cost of transport. Along the Atlantic coast, the use of barges and tugs has been demonstrated to be the cheapest method of moving low-grade bulk freights, such as coal.

The uncertainty of labor for handling cargo at the terminals is one of the conditions that have caused the substitution of the barge in place of the steamboat on those inland rivers where some remnant of water transportation still remains. The barge is inexpensive compared with the steamboat. The barge can be tied up to await the time when labor can be obtained to unload her without keeping idle a whole crew, as happens when a steamboat is similarly delayed. Barge transport is much slower and more uncertain than transport by a steamboat which sails on schedule time, and this makes the barge unsuitable for many classes of merchandise freight. Even for such bulk freight as grain, prompt movement by rail may often protect the shipper from the loss, through changing market price, which he might incur were the shipment sent by water.

Coal Transport by Barges on the Ohio

The most extensive use of barges on inland waterways is on the Monongahela and Ohio Rivers. There are coal mines in the valley of the Monongahela so close to the stream that the mine cars can be dumped directly into the barges in the river. A large proportion of this coal is delivered at Pittsburgh, only a short distance away, but for many years there were large shipments from these mines down the Ohio and the Mississippi Rivers to New Orleans, with a smaller amount to St. Louis and other cities on the lower Mississippi. An Ohio River coal barge holds from 500 to

800 tons. A fleet of 25 or more barges is handled by a single towboat, and at times single tows carrying 50,000 tons or more of coal have gone down the Ohio River. This movement took place only during high water.

The Monongahela River was improved for navigation many years ago by a series of dams and locks. In the pools behind the dams the coal barges accumulate as they are loaded, until a season of high water breaks the blockade and allows the movement downstream to begin.

Under these conditions most of the power for transportation is furnished by the current of the river. The towboat is chiefly used to steer the mass of barges and keep them in the channel. When lumber was cheap, the coal barges used were of light construction, costing less than a dollar per ton of coal carried, and were commonly sold or broken up for firewood or lumber at New Orleans. The cost of towing back and repairing was more than the cost of new boats.

Limitations of Barge Transportation

The transport of coal by this method was the lowest-cost transportation ever known. The tonnage moved in a single unit was greater by far than has ever been moved by any other method. The favorable conditions were partly offset by others. The movement was very slow. Where the empty barge was towed back up the river for another load, the total time required was so great that a barge could make only one or two trips to New Orleans in a year. The risk of loss was heavy. A considerable percentage of the barges were crushed or sunk with their loads. There was no return freight. A small tonnage of merchandise freight could be had, but would not stand the risks and long delay incident to transport on a coal barge. In fact, with the rise in the price of coal, the losses by river transport constitute a considerable handicap to the use of the coal barge compared with shipment by rail.

Nor is the financial factor to be overlooked. On a shipment by river, the coal-mine owner has to store his coal for months while the river is closed by ice or the water is too low for the coal fleet to start, and between one and two months were required for the long voyage to New Orleans. All this time his working capital was tied up. When an operator ships his coal by rail the daily output of his mine is on its way to market in a few hours from the time it is raised from the shaft.

Decline of Coal Shipments by River on the Ohio

The old mines along the Monongahela River from which many millions of tons of coal have gone to the Pittsburgh and New Orleans markets are becoming exhausted. Much of the coal mined in this valley is now being taken from mines located so far back from the river that the coal must be loaded on railway cars at the mine.

Many of the industrial works located in the narrow valley at and near Pittsburgh have facilities for unloading coal from river barges, but elsewhere most buyers of coal can receive it only in cars. On a large proportion of the coal mined and marketed in the Ohio valley, therefore, there must be transfers from the railway car to the barge and back again to the car if the river is to be used for its transport.

For the New Orleans trade, the river coal long had the advantage that much of the coal business was for the supply of ocean steamers, and the river barges could lie alongside the steamer to discharge its load. Within recent years New Orleans is receiving a coal supply from nearby mines in Alabama. This comes by rail and also by water down the Warrior River and through protected waters along the Gulf coast, so that barge transportation is feasible all the way. The mines in the Pittsburgh district have an enormous and profitable nearby market for their coal among the industries of the Ohio valley, and it pays them better now to sell it there than stand the long haul to New Orleans in competition with the nearby Alabama coal. Still more recently oil fuel has largely displaced coal in the New Orleans market.

Traffic Possibilities of the Ohio River

The large tonnage transported on the Ohio River was long the last citadel of those who believed in the future of inland river transport. While on all other inland rivers the official statistics showed the steady decline of navigation, the tonnage on the Ohio River for many years showed a steady though small increase. The great bulk of this tonnage was coal, floated downstream to New Orleans as already recited; yet it was believed to demonstrate the possibilities of inland water transport.

A score of years ago, when some of the Government authorities gave really serious study to the situation and prospects of inland water transport, it was the general belief that the Ohio offered better prospects of becoming an important avenue for transportation than any other river in the country.

Only in a densely populated region of heavy traffic can an inland water route be a success. Water transport can at best be only an auxiliary to rail transport, for boats can only run a part of the year and an industry must depend on rail transport anyway while the boats are tied up.

The great drawback to profitable navigation on the Mississippi River is the lack of business. There is not a city of any size from Memphis to New Orleans. The agricultural products along the lower river are shipped by rail to market. It would be too expensive and difficult to reach the river with its great range of level.

The Ohio valley, however, has become a densely populated industrial region. It produces a vast quantity of bulky products demanding low-cost transportation. It possessed already a large volume of river business. Therefore it was believed that if any river in the United States could command enough traffic to justify its improvement, it was the Ohio.

Plan for Ohio Slack-Water Navigation

There is a fall of about 470 feet in the Ohio River in the 970 miles of its course from Pittsburgh to Cairo, where it joins the Mississippi. The rapid current produced by this fall at high water was rather favorable than otherwise to the downstream transportation of the great coal tows. For upstream traffic, of course, the current was a heavy handicap; but a worse one was the shallow water on the bars during the low-water season.

In the years following the Civil War, engineers believed that inland water transportation had a great

future and that European practice in making swift rivers navigable by the construction of dams and locks should be followed by the United States. Work began on a number of rivers tributary to the Ohio; but the Ohio itself was already navigable by steamboats, so Government work on it was devoted to channel improvements at the worst locations, until 1880, when the first dam and lock were built near Pittsburgh. It was not till 1910 that the Government adopted a complete project for slack-watering the entire river.

This project involves the building of locks and movable dams at 53 different points on the river, and is planned to give a navigable depth of 9 ft. of water at all seasons of the year. The work was estimated to cost $63,731,488, and the annual cost of operation was estimated at $810,000. At present 29 locks and dams have been finished, and 15 more are under construction. On 9 others work has not yet begun. The completed dams control the river from Pittsburgh downstream for about 250 miles. The present estimate of the total cost of construction is $76,434,000. About $50,000,000 has already been expended, besides $7,000,000 for operation and maintenance of the locks and dams already completed. The Government had spent $17,000,000 on the Ohio before the present project was adopted, making a total of $74,000,000 to date.

Water Terminals on the Ohio

In November last, Col. Lansing H. Beach, the engineer officer in general charge of the Ohio River improvement, made a detailed report of the terminal situation on the Ohio River. The necessity for adequate terminals for the economical handling of water traffic is nowhere more evident than on the Ohio. The river has a greater fluctuation of water level, it is believed, than any other navigable stream on the globe. The range between high and low water is from 40 to 70 ft. at different points. The edge of the stream at high water is 300 to 1,000 ft. back from its edge at low water. Terminal facilities at a locality must provide for handling freight at low water and at high water and at every intermediate stage. The structure must not obstruct materially the flow of the river at flood stage. It must provide a convenient and safe landing place for boats, and traffic must not be interfered with by the deposit of mud which occurs at all stages above low water.

The wharf boat, according to Colonel Beach, meets these conditions more fully and more economically than any method that has yet been devised. The boat is moored in front of a paved landing, up which a roadway leads to the top of the bank. The plan in most favor is to transport freight by motor trucks from the wharf boat up the paved roadway and thence to the city's business district. All the larger cities along the river are preparing plans for large and expensive terminals equipped to handle passenger and merchandise freight, and intend to have them ready for use as soon as the river channel improvement has advanced far enough to make low-water navigation practicable.

Colonel Beach made a census of the boats on the Ohio. It shows a total of 35 packets, 71 towboats, 369 flat-boats, 121 coal boats and 965 barges.

The question whether transportation will be developed on the Ohio, turns, in Colonel Beach's opinion, on whether the railways are to be allowed to compete with the water lines or will be compelled to coöperate with them. Colonel Beach recommends that the Interstate Commerce Commission be required to exercise the same supervision over water carriers as over rail carriers, and to fix a minimum rate as well as a maximum rate for water transport. Furthermore, he urges that rail and water carriers should be compelled to issue through bills of lading and prorate with each other under supervision by the Interstate Commerce Commission.

Illustrating the necessity for such changes in the law, to prevent the railways from throttling the river traffic, Colonel Beach gives a list of 19 coal-handling terminals on the river front at Cincinnati which have been abandoned since the railways advanced the rates on river-borne coal formerly distributed from Cincinnati.

In the above-quoted report of Colonel Beach one finds again the tacit assumption that river transportation is inherently cheaper than rail transport, so that if the railways can be prevented from using their powers to compete unfairly with the boats, traffic will gravitate to the river. But is this true? Can the boats carry freight at lower cost than the railways?

In view of the facts developed in the preceding chapters, there is little doubt that in almost every case the determining factor in the movement of traffic will be the cost of handling at terminals and transfer points, not the cost of handling by rail or river.

In discussing the handling of merchandise freight on the Ohio, Colonel Beach clearly sets forth the great difficulties in constructing and maintaining freight terminals, and concludes that the wharf boat is about the only feasible solution.

But landing freight on a wharf boat means at most seasons of the year a long, uphill haul out of the river channel. The wharf boat answers for small shipments, but such shipments are a small part of present-day traffic. The shipper or receiver of carload lots in most cases has a private siding at his works or warehouse and could not possibly afford to ship by water and haul the freight by truck to or from a wharf boat.

In the hearing before the Board of Engineers on the Missouri River improvement, referred to in the preceding chapter, one of the witnesses was the traffic manager of the Kansas City Missouri Navigation Co., a man of long experience in freight handling. He declared that with wharf-boat terminals the river could never compete with the railway. Not until the Kansas City boat line had railway tracks at its terminal wharf, and arranged to take and deliver freight from any private railway siding in Kansas City, was it able to obtain any considerable business.

In the shipment of low-grade freights—coal, coke, stone, ore, lumber, etc.—in the Ohio valley, the determining factor again will be the terminal and transfer conditions. Coal mined on the banks of the Ohio's navigable tributaries, which can be discharged from the mine cars directly into a barge, may in future, as in the past, furnish a considerable traffic on the Ohio when destined to plants directly on its banks. The same thing is true of other bulk freights when shipped from one river-bank point to another, but it is difficult to see how the Ohio River can attract any considerable volume of through traffic where either origin or destination is remote from the river. The added cost of trans-

fer will usually absorb any possible saving of the water rate over the rail rate.

There is one condition which may in future, perhaps, result in a considerable movement of local traffic on the Ohio River. That is the heavy cost of moving freight by rail through congested railway yards. Take for example the movement of materials in the Pittsburgh district between a plant on the Monongahela and one on the Allegheny. The distance may be only a few miles, and yet the cost of moving a car of freight over that distance where tracks are crowded with trains and through congested yards may be as great as the cost of hauling it two or three hundred miles by rail on an open main-line road.

This was the controlling argument, probably, in the recent decision by the Secretary of War to compel the raising of bridges over the Allegheny River at Pittsburgh. There is no volume of traffic now using the river that justifies the great expenditure necessary to rebuild these bridges. It was urged, however, that in future, with the rapidly growing traffic in the Pittsburgh district, the river-front plants will find increasing advantage in moving freight between river points by water instead of by rail.

Financial Aspect of the Ohio River

If the slack-watered Ohio River is to justify the Government's expenditure upon it, it will have to carry an enormous volume of traffic. Of course, the river carrier, here as everywhere, does not compete on an even basis with the railway. The boat owner uses a channel provided and maintained for him free of cost. Even the terminals which he uses are in future to be provided largely at the expense of municipal taxpayers. If the boat rates are lower than the rail rates, therefore, it does not show that water transport is less costly. The water carrier ought to carry goods at lower cost for part of this expense is borne by the taxpayers, while the rail carrier has to provide and maintain his own road and stations and, besides, pay heavy taxes on them.

The latest published estimate of slack-watering the Ohio is $76,434,000. The official estimate of annual operating cost, made when the project was first adopted, was $810,000. Of course, both these figures must be largely increased today. It will probably cost $100,000,000 by the time the Ohio River work is done, and the annual operating cost will be easily $1,500,000. The interest charge, at current rates on Government bonds, should be at least 4½%. Besides this, there must be an allowance for depreciation aside from the ordinary repairs included in the above statement of operating expenses. The first dams built on the Ohio already require reconstruction. A depreciation charge of 1½% allows at least as long a life for these works as can be safely assumed. The total annual cost of the Ohio River navigation works will be then as follows:

Operating expenses	$1,500,000
Interest	4,500,000
Depreciation	1,500,000
Total	$7,500,000

Thus the Ohio River, if it is to justify the Government's outlay upon it as an economical transportation route, must carry traffic enough so that the saving in freight over the cost of sending the same goods by rail will be at least $7,500,000 per annum. Even then, the river will not be effecting any real service to the country. The net result will be to take about $7,500,000 from the Federal treasury and distribute it among a few thousand shippers who are in position to send goods by the Ohio River, and eventually among a few million consumers, who may perhaps benefit by part of the saving which these shippers make.

VIII—The New York Barge Canal

The greatest investment in a single inland waterway ever made in the United States—or, for that matter, in the world—was the construction of the New York Barge Canal by the State of New York. The total amount of bond issues by the State for this work is now $154,500,000.

The original Erie Canal, which the Barge Canal replaces, was, during the first fifty years of its history, from 1825 to 1875, a factor of enormous importance in the transportation system of the United States. As the only water route between the Mississippi valley and the Atlantic seaboard, it exercised a controlling influence on transportation rates for half a century. The traffic on the canal continued to grow until 1880; but during the fifteen years following the Civil War it became increasingly evident year by year that the supremacy of the canal had departed. The business of the railways grew many times as fast as the business of the canal.

The tolls which were paid by boats using the canal down to 1880 were sufficient to pay the operating expenses and also repay to the State its entire expenditure on the canal. In the hope that the canal might hold its own in competition with the railways, the tolls were abolished in 1880; but this had no effect in stimulating business, and the continuous decline of traffic on the canal dates from that year.

New York City Commerce and the Erie Canal

The preëminent commercial position of the City and port of New York was originally attained, according to common belief, as a result of the Erie Canal water route. The export grain merchants of New York in the years from 1880 to 1900 found their business diverted to the rival ports of Baltimore and Newport News. Led by prominent men in this trade, the commercial interests of New York urged the reconstruction of the Erie Canal to make it a water route which could again hold its own against all competing routes, as did the original Erie Canal.

Many plans for the enlargement of the canal were discussed, but that finally adopted in 1901 was for a waterway capable of accommodating barges of 1,000-ton capacity. Before work had proceeded far, alterations were made in the depth and width so that boats of a maximum capacity of 2,000 tons would be able to navigate the canal. Elaborate computations were made to demonstrate that barges of this size could transport grain from Lake Erie to New York City at so low a price as to be superior to any possible railway competition.

A Canal Designed to Compel Freight Transfers

There was, however, one governing motive in the design of the canal which did not appear on the surface. It was the intention to have the canal able to carry business from Buffalo to New York in competition with

railways, but not commodious enough for vessels to navigate the lakes or the ocean. A waterway which would do this would, of course, eliminate the necessity for transferring freight at Buffalo and also at New York City. It was the commercial interests in these two cities—or, more specifically, those engaged in the storage and transfer of grain—that brought about the adoption of the canal project against the opposition of the rest of the state.

Not only is the new barge canal too shallow to admit deep-draft lake vessels; but the canal is crossed by many fixed bridges with only 15½ ft. headroom above water level. This, of course, prevents the operation on the canal of lake or ocean vessels of the ordinary type, even those of very small size, and was believed to insure Buffalo absolutely against the loss of its transfer business on traffic through the canal.

That the projectors of the barge canal were far from possessing a broad view of the transportation problem is shown by their total neglect of the terminal problem, in their original plan. Not until work on the canal had been in progress for several years did anyone awake to the fact that unless the canal was provided with adequate terminals along its route it would be unable to handle business economically. An additional bond issue was made by the state in 1912; under this, terminals have been undertaken at the various cities along the line of the canal. When the barge canal was planned, in 1900, the old Erie Canal and the other canals in the state canal system were still handling about 3,000,000 tons a year.

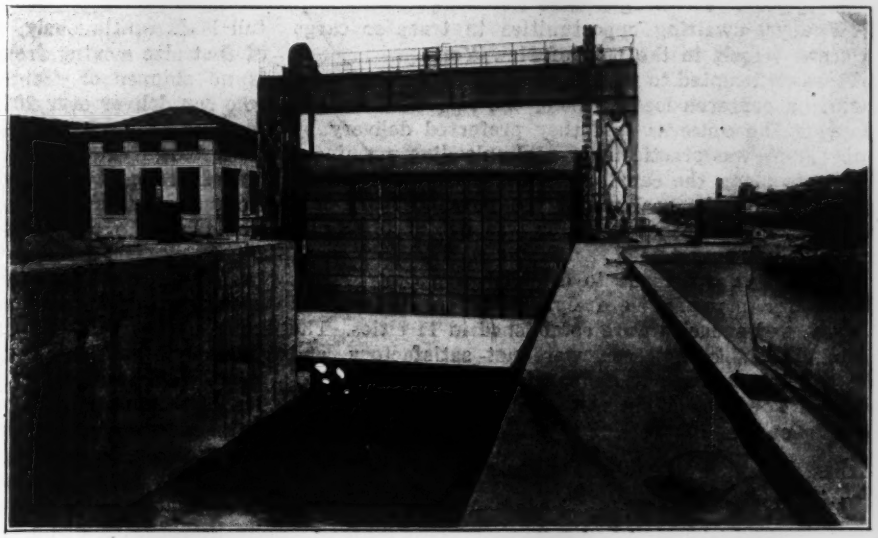
Most of this, however, was business of local importance. The canal had ceased to be an important competitor of the railway. Of the total traffic, only about one-third was tonnage moved toward tidewater on the Erie Canal, the object for which New York originally embarked in the canal business.

It was, naturally, expected that the prospect of the new waterway would stimulate the canal business; but during the years while construction on the Barge Canal has been in progress, traffic on the canal has rapidly declined. In 1917, the total freight moved on all the canals of New York State was only 1,297,000 tons. Less than 100,000 tons of this was moved toward tidewater on the Erie Canal, and only 18,000 tons of this was grain and other agricultural products. Thus the grain trade, which the canal was, originally, chiefly planned to accommodate, had practically disappeared.

The loss of this grain business by the canal was not due merely to the competition of the railways which parallel it. The importance which the Great Lakes at one time held for east and west traffic has departed. Grain shipped by all-rail routes to Baltimore and Newport News competes successfully with the all-rail and lake-and-rail routes to New York and New England seaports. There has also been a great movement of the centers of grain production. The states of the upper Mississippi valley, which formerly sent enormous quantities of grain to the seaboard, now ship their products in the form of dressed meats. The grain-raising region west of the Mississippi, which has become important in the past thirty years, now exports a large share of its product by way of New Orleans and Galveston, instead of the Atlantic ports.

Lack of Boats for the New Canal

With the approaching completion of the Barge Canal, there has been much question as to where the boats were coming from to use what the state has provided. Here is a transportation route on whose creation over



ON THE NEW YORK BARGE CANAL—MANY LOCKS, BUT NO SHIPS

$150,000,000 has been expended, for the free use of anyone who desires to operate boats upon it. But there are no concerns in sight, ready with the capital and the organization to build and operate boats and carry on transportation on the scale which those who planned the canal nearly twenty years ago contemplated.

There are still left seven or eight hundred of the old wooden Erie Canal boats, most of them in an advanced stage of decay. Few new boats have been built in recent years. The reason assigned was that it was unwise to build small boats when the enlarged canal was so near completion, and it was equally unwise to build large boats until the canal was ready to accommodate them.

Following the entry of the United States into the war came an unprecedented congestion of the railways and an insistent demand for supplementary means of transportation. Attention was at once turned to the New York Barge Canal, but it was found that few of the old-time canal boats were in decent condition, and also that their operators were unable to meet the demand for reliable and regular service. The conditions of the labor and material markets were not such that anyone could undertake the building of boats by private enterprise.

The Federal Railroad Administration, therefore, in May, 1918, undertook to create facilities for the use of the Barge Canal. Contracts were let for new barges,

but it was not possible to complete these in time for the summer of 1918. The Federal railway manager in charge, therefore, leased some 200 of the old canal barges and towboats and undertook to carry on a transportation business with them.

The official report of Director General McAdoo, at the end of 1918, stated that the expectation was that a heavy eastbound canal business in grain would develop for these boats; but, as a matter of fact, this grain was shipped by the owners by rail. Notwithstanding the railway congestion of 1918 and the fact that the canal passes through a densely populated industrial region, the vessels of this Government fleet were idle on account of no cargoes, a total of 3,367 days from the time their operation began in May until the close of navigation. The barges were also delayed a total of 1,445 days, awaiting opportunities to transfer cargo to ocean vessels in the port of New York.

It was attempted to move coal by the canal to manufacturing concerns located along the line of the canal. Many of the concerns said they preferred delivery by rail. There was practically no coal-unloading machinery for boats along the canal. The concerns which might have received the coal would not purchase such machinery, and the canal manager was not at liberty to make such an investment.

An attempt was made to establish a packet freight service for merchandise freight between Buffalo and Albany, and agencies were established in 11 cities. The boats obtainable, however, were not satisfactory, and the enterprise was not a financial success. Later results in Government operation on this canal are given in a following chapter.

Experience in Commercial Operation on the Canal

It is of interest to turn, now, to the experience of the only incorporated company now carrying on a commercial business on the barge canal, the Shippers' Navigation Co., of New York and Syracuse.[1] This company operates a fleet of about 50 barges between Buffalo and New York City. These barges are of only about 300-ton capacity. The new boats which the company plans to build to enlarge its fleet will be of the same capacity, or very little larger than the boats which were used on the old Erie Canal.

In other words, notwithstanding the huge investment by the state to make a waterway capable of moving large boats, the leading concern now doing business on this waterway finds the size of boat used in the old canal a more profitable carrier.

The reasons for this are illuminating, for they bring out in strong relief the necessity for studying actual commercial conditions in solving transportation problems. Engineers have become accustomed to assume as axiomatic that the larger the size of carrier the cheaper will be the transportation. Such assumptions may lead to most dangerous errors and serious losses.

Advantages of Small Boats

Some of the reasons why the company is continuing the use of the 300-ton barge are as follows: The canal is closed to traffic five to six months of the year. A company engaged in transportation business must maintain its organization and activities the year round. The 300-ton barges which run on the canal in summer are used during the winter in lighterage business in and about the port of New York. Such use is, if anything, more profitable than use during the navigation season on the canal. A 300-ton barge is about as large as can be profitably handled in the lighterage business.

Even when the canal business alone is considered, the economical size of boats is determined not only by conditions in the eastward movement of traffic but by those of the westward movement as well. In order to do a paying business in operating boats on the canal, it is necessary to seek return cargo. Even if a great volume of grain were moving from Buffalo to New York, so that boats of 1,000 to 2,000 tons could obtain full loads continuously, there is no business for boats of that size moving from New York westward. There is no shipper of freight in the port of New York who can deliver over 200 tons of freight at one time—for lack of space to store it, if for no other reason. If a barge of 800- to 1,000-ton capacity had to be moved around to four or five different points in New York harbor to take on its load, its delays in port would be so great as to absorb any saving due to its larger size. Further than this, there are only two business concerns between New York and Buffalo big enough to receive more than 200 tons of freight at one time.

Even if a 1,000-ton or 2,000-ton barge loaded with grain were brought to New York, it could seldom be unloaded economically. Most export grain from New York is taken by ocean liners. These carry also general cargo, which pays a higher rate than grain, and they take such grain only as may be necessary to fill up. Thus it is likely that only one or two holds in an ocean vessel will be loaded with grain.

If a 1,000-ton barge were brought alongside an ocean steamer lying in her slip, the barge would be so long as to interfere with the transfer of cargo to other holds than the one receiving grain. The barge might also be so wide, with the portable grain elevator lying alongside, as to block the movement of other vessels in the slip.

These facts are an illuminating illustration of how transfer conditions at the terminals, and not the condition of transport, are the determining factor in controlling routes of transportation today. Another significant fact of the same sort is that the Shippers' Navigation Co. is engaged only in through business between New York City and Buffalo. On that business it professes itself able to move traffic at about 80% of all-rail rates, including in this marine insurance on the goods handled, which it has to give to place its service on a parity with rail service. On shipments for shorter distances on the canal, the company states that the saving by the water route is not enough to enable it to compete with the rail rate.

There may be those who will argue that the company might, by using 1,000- or 2,000 ton barges, so reduce its transportation costs that it could compete with the railway on the shorter-distance hauls. Before accepting such an idea it will be well to consider the very economical method by which the company now moves its boats. One power boat (which also carries cargo) pushes one barge ahead and tows four behind. Thus a single crew moves some 1,800 tons in a single fleet.

[1] This is the only company operating on the barge canal proper. The Lake Champlain Transportation Co. is a long established company operating barges between New York and Canadian points via the Hudson River, the Champlain Canal, Lake Champlain and the Canadian canals.

or about the same amount as a 2,000-ton self-propelled barge would carry. Apart from the commercial conditions just explained, therefore the 300-ton barge when thus moved in fleets is very likely as cheap a carrier, when all the items of interest, depreciation, labor and power are included, as the 2,000-ton barge.

Limitations in Canal Operation

And it must also be set down here that the canal usable by 2,000-ton barges is still uncompleted. The boats now using the canal are still limited to 8½ ft. draft as a maximum, even on the sections which are supposed to be entirely completed, such as the Champlain Canal from the Hudson River to Lake Champlain. The draft which vessels will finally be able to carry on the canal remains to be determined. Other considerations come in besides the depth over the lock sills.

The common idea is that transport on a canal is absolutely devoid of danger, and this is true so far as such perils of storm as threaten ocean vessels are concerned; but the chief danger to all floating craft is grounding; and a loaded canal barge is always moving with her hull close to the bottom of the channel. Along the canal a sudden local summer shower may discharge into the channel a few cubic yards of sand and gravel, just enough for a boat to run aground on, strain her hull and start leaks that will fill her with water before she can be floated off. Of course, the boat with her cargo is not lost, and salvage is easy; but the injury to the cargo by water and to the hull and the delay, involving, perhaps, other boats besides the one which grounded, count up very heavily in dollars and cents.

Other dangers occur in the sections where the channels of the Mohawk River and upper Hudson River are used for navigation. When these rivers are in flood, heavy currents may drive boats out of the channel, and the deposits from each flood may produce shoals which will endanger boats when the river falls again. If the theoretical depth of 12 ft. is finally made actually available for safe use by boats of 10-ft. draft, frequent dredging will be necessary to keep the channel free from the deposits it is constantly receiving.

Operations on the Champlain Canal

The firm of Witherbee, Sherman & Co., which operates extensive iron mines a few miles back of Port Henry, near the southern end of Lake Champlain, is using the Champlain Canal on a considerable scale. The late Frank S. Witherbee, former head of this firm, was a member of the commission appointed by Governor Roosevelt in 1900 which made the original plans for the Barge Canal.

This firm has a fleet of canal barges which load ore at Port Henry and transport it down the lake to Whitehall, through the Champlain Canal to the upper Hudson and down that river to New York, a total distance of about 265 miles. The boats used are wooden barges of about 500-ton capacity, built with timbers heavy enough to stand the load of ore and the service of the five-ton grab-bucket which is used in unloading the ore. The boats are operated in fleets, one power boat moving usually four others. The firm has built a 1,000-ton barge, but has not yet put it in operation on account of the channel conditions just explained.

Besides this company the Lake Champlain Transportation Co. operates canal barges between New York and Montreal, traversing the Hudson River, the Champlain Canal, Lake Champlain and the Canadian canals from the foot of Lake Champlain to the St. Lawrence. The tonnage moved on the Champlain Canal approaches that of the Erie Canal.

Hon. Henry W. Hill of Buffalo, testifying before the House Committee on Interstate and Foreign Commerce on Sept. 16, 1919, declared that the State of New York had constructed the best canal system in the world. It is open for the free use of commerce without tolls and the state even operates tugs which haul barges for their owners at a charge less than the cost of operation.

Mr. Hill was one of the prominent figures in bringing about the undertaking of this waterway, nearly twenty years ago. The statistics showing the decline of traffic on the New York canals, given by Mr. Hill himself at the conclusion of his testimony, are a more eloquent demonstration of the business failure of the project thus far than words could possibly be. They are as follows:

TOTAL TRAFFIC ON ALL NEW YORK CANALS

Year	Tons Carried
1914	2,080,850
1915	1,858,114
1916	1,625,050
1917	1,297,225
1918	1,159,270

These figures show that the traffic on the canals has steadily declined during five years, when the congestion of transportation lines has been greater than was ever before known. During the present year, 1919, the total traffic on the New York canals up to Nov. 1 was 1,074,308 tons, an increase of only 7% over 1918, notwithstanding the added facilities afforded by the Federal Government fleet of barges.

What the Canal Freight Costs the Taxpayers

Of what did this 1,074,308 tons of freight consist? Over one-third was sand, gravel, stone and clay. The balance was made up of such low-grade freight as coal, iron ore, ice, lumber, pulpwood and forest products. When this tonnage of low-grade freight is deducted, the total traffic of higher class merchandise on all the New York canals this year to Nov. 1, was only 367,000 tons in round numbers.

But we shall get a still clearer idea how completely is the New York barge canal a business failure if we examine the statistics of traffic on the Erie Canal alone —the waterway across the state from Lake Erie to the Hudson River. It was on this section that the bulk of the state's $155,000,000 was spent, and it was the hope of a vast flow of traffic over this route that induced the state to undertake the enterprise. The figures of total traffic for the season of 1919 to Nov. 1 on the Erie Canal alone are as follows:

Total tonnage		730,000
Sand, gravel, stone and clay	332,734	
Ice	26,932	
Lumber	22,979	
Coal	25,640	
Salt	28,815	
Total low-grade freights		437,100
Balance, all other freight		292,900

Twenty years ago the sanguine promoters of the barge canal figured on the vast volumes of grain which would seek that waterway. In the present year, up to Nov. 1, all the wheat and corn carried on the Erie Canal amounted to only 15,926 tons.

The taxpayers of New York are paying annually about $6,000,000 in interest charges on the bonds

issued to build the state canals and about $2,000,000 additional to operate and maintain these canals, or about $8,000,000 per annum in round numbers. At least three-fourths of this expenditure is chargeable to the Erie Canal, so that the cost to the taxpayers is about $8 per ton to have 730,000 tons of freight carried by water instead of by rail. If we exclude the low grade freights, we have $6,000,000 outlay by the taxpayers to have less than 300,000 tons of higher class freight carried by water, or over $20 per ton moved.

It needs no argument to prove that unless the New Yok canals can attract a far larger traffic than now uses them, it will be absurd to burden the state's taxpayers indefinitely with the heavy cost of the canal operation and maintenance.

And it must be said that no material increase of traffic on the New York canals is now in sight. Aside from the boats built for the Federal Government, an occasional barge built for some individual, and a few boats for the Shippers Navigation Co. above noted, no boats are being built for use on the canals. And the reason is obvious. There is no prospect of profit in the inland water transportation business sufficient to attract capital because of the low cost with which freight is now moved by rail.

Had Mr. Hill and the other waterway enthusiasts, who nearly a score of years ago induced the State of New York to embark in the barge canal enterprise, foreseen the steady disuse of the waterways by shippers which these figures show, the work would never have been undertaken.

It may be put on record here that the present writer opposed the barge canal project at its inception and published, in *Engineering News* nearly twenty years ago, a symposium of opinions from able engineers and transportation experts to the effect that the canal, when built, could not transport traffic at a lower cost than the cost by rail. But the barge canal promoters were deaf to the opinions of engineers and chose rather to be guided by the opinions of merchants who were seeking to benefit their own business.

(To Be Continued)

Method of Creation and Powers of Joint Sanitary Districts in Ohio

On Petition, Courts May Create Stream Sanitation, Sewerage and Water-Supply Districts to Build and Maintain Works

JOINT sanitary districts composed of two or more political subdivisions are authorized by an act of the Ohio legislature of 1919. Such districts have power to prevent and correct stream pollution; to clean and improve stream channels; to regulate stream flow for sanitary purposes; and to construct water-supply and water-purification works and sewerage and sewage-treatment systems. The formation of sanitary districts is under the control of the Court of Common Pleas of the county in which the district is located. If the district is in more than one county, the court of jurisdiction is composed of a judge from the Common Pleas Court of each county represented. Proceedings for the formation of sanitary districts may be instituted by petitions signed by 500 freeholders, or by a majority of the freeholders, or by owners of more than half the property in area or in value within the limits of the proposed districts; in place of freeholders, the proceedings may be started by the governing body of any public corporation lying wholly or partly within the proposed district. In the case of water-supply districts the petitions must be signed by the governing bodies of each municipality in the proposed district, or by a majority of the freeholders of each political subdivision or part thereof included, and also by any public-service corporation supplying water in the proposed district. After a public hearing and an adjudication of all questions of jurisdiction, the court with whom any such petition is filed may grant the petition for a sanitary district, and on doing so shall notify the Secretary of State, whereupon the district becomes a political subdivision of the state.

Sanitary districts thus created are administered by a director, or by a board of directors if in more than one county, appointed by the court with jurisdiction so as to give each county in the district one director. Any such director or board of directors is authorized to appoint a chief engineer, attorney, secretary and such other officers, agents and assistants as may be necessary, and to fix their compensation.

Where a district has been organized for purposes other than public water-supply, no outlet for the discharge of sewage or other liquid waste, and no sewage-treatment or disposal works shall be built in the district until the plans therefor have been approved by the district director or directors.

District boards shall cause a plan to be prepared for the improvement for which the district was formed and shall submit such plans to the state department of health for approval. The plan shall then be open for inspection and objection before adoption as the official plan of the district, but if within 10 days of approval objections are filed with the court with jurisdiction, the court shall give a hearing and then either adopt or reject the plan, or else refer it back for amendment. If rejected, a new plan must again be submitted to the court.

When the plan is finally approved by the court, the director or directors of the district have authority to execute it. If it is decided to do the work by contract, then "contracts in amounts to exceed $10,000 shall be advertised" and the board "may let said contracts to the lowest and best bidder."

Appraisers recommended by the district directors must be appointed by the court with jurisdiction to appraise lands taken for district use and also damages, if any, "accruing to cities, villages, counties, townships and other public corporations, as political entities, and to the State of Ohio," the appraisements to be subject to approval by the court and to adjudication by it if objections are filed.

To finance a district, the act provides for preliminary, bond and maintenance funds. The bond fund is supplied by bond issues met by assessments on the property benefited, such bonds not to exceed 90% of the total assessments. Maintenance funds are to be raised annually by assessments for benefits, but in any one year shall not exceed 1% of the benefit assessments for construction, unless specifically authorized by the court. In the case of works for water-supply the maintenance fund is to be provided from the sale of water.

Compensation for directors and appraisers is to be fixed by the courts with jurisdiction, according to the time devoted to the work.

Silt Problem of River Reservoirs

Zuni Reservoir Will Become Useless Unless Deposit Is Removed—Removal Is a Difficulty—Similar Cases Are Cited

LOSS of 60.7% of the capacity of a reservoir in 12½ years due to silting which averaged 4.86% annually is the condition which obtains at the Zuni reservoir of the U. S. Indian Irrigation Service near Gallup, New Mexico. At this rate, by 1921 the storage will be insufficient for a normal year, while in 1926 the silting will reach to within 1 ft. of the present spillway level. If this level is raised 10 ft., the reservoir will be filled with silt by 1939. These conditions are described by H. F. Robinson in a paper on "The Silt Problem of the Zuni Reservoir" in the "Proceedings" of the American Society of Civil Engineers for August, 1919, page 483.

This silt problem must be faced in practically all reservoirs in the western part of the country, especially those formed in the bed of a stream by damming the channel, says Mr. Robinson, and unless some means can be found for removing the deposit it will impair the storage capacity and eventually fill the basin. This is true particularly of flashy streams which are dry for a considerable portion of the time and subject to freshets and floods at intervals. These floods coming down the dry bed will cause greater erosion than if the bed was continually wet. It is stated that Lake McMillan, in New Mexico, lost 60% of its capacity in 15 years, while the Austin reservoir in Texas lost 38% in four years and 48% in seven years.

The Zuni reservoir is formed by a dam in the Zuni River, built in 1902-1907. Its capacity is 15,811 acre-feet at the original spillway elevation of 1000 ft. above sea level and 10,213 acre-feet at the 991-ft. elevation, which has been maintained since a failure of the original spillway in 1909 (see *Engineering News*, Dec. 2, 1909, p. 597). With the dam in this position all silt is caught in the reservoir, except that which passes out through the valves or is carried over the spillway when the water is flowing into a full reservoir. Observations indicate that in four years the silt deposited was 3.2% of the runoff; in the next 1½ years it was 5.4% and in the next three years 7.3%. Wet seasons then changed the conditions, so that during the four years ending in January, 1918, the silt percentage was only 0.58%. For the period of 12½ years, the runoff has been 326,648 acre-feet and the silt deposit 5507 acre-feet, the average silt deposit being 1.88% of the water flow. A sample showed an apparent proportion of 55% of silt after one day, which decreased to 16% in four months, after which no further settlement was expected.

Higher percentages of silt content in rivers of the southwest region are noted by Mr. Robinson. In the Rio Grande, from 1897 to 1912, the range was from 4.14% in 1911 to 0.78% in 1905, but there was a maximum of 14.87% for one day and a monthly mean of 7.9%, the former representing about the maximum quantity ordinarily carried in suspension. A sample from Bonito Creek, in Arizona, showed over 13% of sediment after 30 days, while a sample taken during a flood in the Moencopi Wash, in Arizona, showed 85% sediment and 15% turbid water after two days, so that the flood flow was practically liquid mud. The Kaw River, in Kansas, has shown from 41.6% to 80.7% of silt.

This last case has been assumed to indicate the extraordinary influence of great floods in causing erosion, but Mr. Robinson states that while this may be true for large rivers it does not seem to apply to the flashy streams of the southwest. In these streams the lesser volume of water in a year, coming in a few periods of runoff, seems to carry the greatest quantity of silt. He suggests that during such lesser runoff the ground is dry and easily eroded by the flood while during the greater runoff it is moist and therefore not so subject to erosion.

Removal of the silt is a difficult problem that must be faced or the Zuni project will have to be abandoned within 20 years. It will be necessary to raise the spillway capacity in a year or two as the present water capacity of the reservoir is only slightly in excess of one year's need for the 3500 acres now under cultivation. Riprapping the banks to prevent erosion has been suggested, but Mr. Robinson considers this of doubtful utility and impracticable on account of the length of the main stream, while water at the head of feeder streams appears to be as heavily charged as that of the main stream. Large sluices at low elevations are not likely to be of much effect. Experience with such sluices at the St. John's reservoir, in Arizona, and the Austin reservoir in Texas, indicate that the only result would be a channel in the silt, no wider than the opening and extending back for a short distance with almost vertical sides.

An automatic suction dredge apparatus, as proposed by J. H. Quinton, consulting engineer for the project, is considered by Mr. Robinson to be the only plan that seems feasible. This plan includes a floating pipe line connected with the lowest valve in the outlet tower, which valve is below the present bottom of the reservoir. On a barge would be mounted a cutter and nozzle, with a small vacuum pump and a gasoline engine to operate the cutter. With a flow started through this pipe line, no further power would be required except for the vacuum pump, connected to the highest point on the pipe line. If all the water drawn from the reservoir was taken out in this way large quantities of silt would be removed. On the other hand, in dry seasons there would not be sufficient water to waste, so that the silt-laden water would have to run into the canal, which has no silt trap. Thus the silt might fill up the two siphons or be deposited along the canal, causing considerable expense and trouble for its removal.

Water Power from Yangtze River

A scheme has been elaborated by S. J. Powell, according to *The Engineer*, London, for the utilization of the water powers of the Yangtze River in China. Working on the assumption that the flow of the river at Chungking varies between 75,000 cu.ft. per second at low water up to over ten times that amount during the average flood, he estimates that a total of 31,000,000 hp. could be got from the river. The scheme includes the erection of seven dams to maintain the river always at flood level, thus eliminating the rapids between Wushan and Chungking. These dams would be constructed at Wushan, Kueichaufu, Nganping, below Yunyanghsien, above Siaokiang, above Chungchow, and at Fuchau. Each dam would have three locks, with a lift of 18 ft. 8 in. The estimated cost is £8,260,000, made up as follows: Improvement of rapids, £450,000; dams and locks, £7,210,000; hydro-electric plant, £600,000.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Our Engineers in France

HISTORICAL REPORT OF CHIEF ENGINEER, AMERICAN EXPEDITIONARY FORCES, 1917-19: Including all Operations of the Engineer Department. Washington, D. C.: War Department. Cloth; 6 x 9 in.; pp. 437; illustrated. 90c from Superintendent of Documents, Washington, D. C.

To bring into so small a volume a readable review of the operations of the engineers under the command of the chief engineer of the American Expeditionary Forces, numbering 174,000 officers and men on Nov. 11, 1918, is a feat that deserves hearty commendation. The task was successfully achieved by giving in the main report, now available, "the salient features of the organization and operations of the Engineer Department," and by reserving for appendixes the "technical discussion, departmental and special reports, regimental histories" and other detailed matter.

The main report is written in three parts: (1) Organization and development of the Engineer Department from May 18, 1917; (2) military engineering, including all special services—such as water-supply; (3) supplies, construction and forestry. A few pages at the end are devoted to the "chief engineer's observations and recommendations covering the future organization and activities of the Engineer Service, in relation to another possible great war."

Well selected illustrations, both line and halftone, add to the interest and value of the report which was prepared under the direction of Major General W. C. Langfitt, chief engineer, A. E. F. The report will be prized by all who took part in the operations reviewed, besides appealing to engineers generally. The price of less than a dollar put upon the volume by the superintendent of documents brings the report within the reach of all who wish for it, provided their order is sent in before the edition is exhausted.

Reinforced-Concrete Handbook

USEFUL DATA: On Reinforced Concrete Buildings for the Designer and Estimator—By the Engineering Staff of the Corrugated Bar Company, Inc., Buffalo, N. Y. Leather; 5 x 8 in.; pp. 216; illustrated.

Steel designers have become so used to the structural handbooks, Cambria, Carnegie, and their like, that they hardly realize what it would mean not to have them. Concrete designers, however, have never had in their particular field a satisfactory handbook of this sort. The one or two efforts which have been made have not proved successful enough to be remembered by the run of engineers. The book "Useful Data" just issued by the Corrugated Bar Co., gives promise of a more hopeful future.

It fairly represents the concrete analogue of the steel handbook. A small part is devoted to the usual list of standard mathematical tables and of physical constants which are necessary to the designer, but the main features are tables and diagrams of design founded on the standard theories as applied by the engineers of the company. These references are remarkably complete and are prepared for all possible variations in stress and load units, so as to be applicable to varying specifications and conditions. While the company has prepared these data from its own designing experience, it has been very free from imposing any of the requirements of its own products, so far as can be seen.

Such books are not for the novice. One ignorant of the principles of reinforced concrete cannot hope by the aid of such a collection of data to become a finished designer. The knowledge of what to reject and how to utilize information comes only with practice, but for rapid or preliminary designing, and for checking, the tables and diagrams should be most useful to those who in theory are well enough grounded to know what they are doing.

Unfortunately for our readers, we are not permitted by the post-office department to state here how much this book will cost them. It must suffice to quote the following letter from the company: "We are offering the book to those of the engineering profession who may be interested, at a nominal price, merely covering the actual mechanical cost of the printing and binding.

Turneaure and Maurer Revised

PRINCIPLES OF REINFORCED CONCRETE CONSTRUCTION—By F. E. Turneaure, Dean of the College of Engineering, University of Wisconsin, and E. R. Maurer, Professor of Mechanics, University of Wisconsin. Third Edition, Revised and Enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 485; illustrated.

For so comparatively novel a material as reinforced concrete, knowledge is in a continual state of change. True, the rate of change is steadily decreasing, and standards and theories are becoming stabilized, but new information continues to develop. To keep up with this progress, a text such as Turneaure and Maurer must be revised at fairly short intervals. This responsibility the authors recognize. The current edition, just issued, is the third; the other two appeared in 1907 and 1909.

To cover completely a given field is honor enough for any book. Such honor may truly be given to this treatise in the field of reinforced-concrete theory. To the study of the concrete itself or of the materials that go to make it only cursory attention is given. The treatment of completed structures is only sufficient to illustrate applications, but the book brings down to the latest date the applications of those principles of mechanics underlying the design of reinforced concrete. For reference or for study it is informing and authoritative.

The third edition, besides being somewhat rearranged, has more extensive treatment of the theory of beam action, and new and up-to-date matter on flat slabs and continuous beams. It is in those subjects that most has been learned since the second edition was issued.

Delaware Issues Health Bulletins

The *Delaware Health News*, as the new monthly is called, is issued by the State Board of Health at Dover. Chester H. Wells is special health commissioner and sanitary engineer to the board.

PUBLICATIONS RECEIVED

Under a Postoffice Department ruling made applicable to *Engineering News-Record* in July, 1919, it is no longer possible to give the prices of new publications announced under this head or of books reviewed in the preceding columns. Readers will therefore have to obtain this information as best they can. Most of the public documents and of the pamphlets announced may be obtained free on application, or at least by paying postage. So far as possible, the name and address of the publisher of each book and pamphlet are given in each entry.

ANNUAL REPORT OF THE DIRECTOR BUREAU OF STANDARDS, June 1918-19—Washington, D. C.: Bureau of Standards. Paper; 6 x 9 in.; pp. 293.

ANNUAL REPORT OF THE SUPERINTENDENT, UNITED STATES COAST AND GEODETIC SURVEY, June, 1918-19—Washington, D. C.: U. S. Coast and Geodetic Survey. Cloth; 6 x 9 in.; pp. 150; folding maps.

BEHAVIOR OF WROUGHT MANGANESE BRONZE EXPOSED TO CORROSION WHILE UNDER TENSILE STRESS—By P. D. Merica, Physicist, and R. W. Woodward, Associate Physicist, Washington, D. C.: Bureau of Standards. Paper; 7 x 10 in.; pp. 9; illustrated. 5c. from Superintendent of Documents.

BUILDING ORDINANCE—Chicago, Ill.: National Lumber Manfacturers Association. Cloth; 5 x 8 in.; pp. 60; illustrated.
This standard "building ordinance" is intended to be used as a model by small towns or cities, where there is no code in existence. Unfortunately for its wide use it over emphasizes the lumber end of building.

BUILDING THE PACIFIC RAILWAY: The Construction-Story of America's First Iron Throughfare Between the Missouri River and California, etc.—By Edwin L. Sabin. Philadelphia and London: J. B. Lippincott Co. Cloth; 5 x 8 in.; pp. 317; illustrated.

ECONOMICS OF THE CONSTRUCTION INDUSTRY—Washington, D. C.: U. S. Department of Labor. Paper; 6 x 9 in.; pp. 263; illustrated.

EFFECT OF VIBRATION, JIGGING AND PRESSURE ON FRESH CONCETE—By Duff A. Abrams, Professor in Charge of Structural Materials Laboratory, Lewis Institute. (Authorized Reprint from the Proceedings of the American Concrete Institute, Vol. XV, 1919) Chicago, Ill.: The Laboratory. Paper; 6 x 9 in.; pp. 23; illustrated.

FOREST DEVASTATION: A National Danger and a Plan to Meet It; Submitted for Consideration to The Society of American Foresters by The Committee for the Application of Forestry. Stanford University, Cal.: The Society. Paper; 6 x 9 in.; pp. 37.

HIGHWAY INSPECTOR'S HANDBOOK—By Prevost Hubbard, Chemical Engineer, The Asphalt Association, Formerly Chief, Division of Road Material Tests and Research, Bureau of Public Roads, U. S. Department of Agriculture. New York: John Wiley & Sons, Inc., London: Chapman & Hall, Ltd. Flexible Fabrikoid; 4 x 7 in.; pp. 372; illustrated.

MECHANICAL PROPERTIES AND RESISTANCE TO CORROSION OF ROLLED LIGHT ALLOYS OF ALUMINUM AND MAGNESIUM WITH COPPER, WITH NICKEL, AND WITH MANGANESE—By P. D. Merica, Physicist, R. G. Waltenberg, Assistant Physicist and A. N. Finn, Associate Chemist, Bureau of Standards. Washington, D. C. Bureau of Standards. Paper; 7 x 10 in.; pp. 13; illustrated. 5c. from Superintendent of Documents.

NEW IDEALS IN THE PLANNING OF CITIES, TOWNS AND VILLAGES—John Nolen, Town and City Planner. New York: American City Bureau. Cloth; 5 x 8 in.; pp. 138; illustrated.

THE NEW WATER SUPPLY SYSTEM OF VICTORIA, BRITISH COLUMBIA—New York: Sanderson & Porter. Paper; 8 x 11 in.; pp. 16; illustrated.

ANNUAL REPORT OF THE DIRECTOR OF THE BUREAU OF MINES: June 1918-19. Washington, D. C.: Bureau of Mines. Paper; 6 x 9 in.; pp. 120; illustrated. 15c. from Superintendent of Documents.

NOTES ON GRAIN PRESSURES IN STORAGE BINS—By W. J. Larkin, Jr., Consultant in Bulk Grain Handling. Washington, D. C.: United States Department of Agriculture. Paper; 6 x 9 in.; pp. 16; illustrated. 5c. from Superintendent of Documents.

OUT OF THE RUINS—By George B. Ford, American Red Cross Reconstruction Bureau in France. New York: The Century Co. Cloth; 5 x 8 in.; pp. 263; illustrated.
Reviews the devastations of war in France and the public and private measures for relief during and since the war as well as the various efforts at reconstruction, including recent progress by the French Government. Contains a large amount of statistical detail in small compass which, with other information is effectively presented. The text is eloquently supplemented by the illustrations.

PRINCIPLES OF INDUSTRIAL ORGANIZATION—By Dexter S. Kimball, A.B., M.E., Professor of Machine Design and Construction in Sibley College, Cornell University. Mem. Am. Soc. M. E. etc. Sound Edition, Revised and Enlarged. New York: McGraw-Hill Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 325; illustrated.
Rearrangement, revision and enlargement of a book originally based on lectures before the seniors of the Sibley College of Mechanical Engineering, Cornell University. The first edition was noticed at length, and favorably, in "Engineering News," Jan. 15, 1914, p. 157, and more briefly in "Engineering Record," Sept. 15, 1913, p. 560.

SEATTLE HARBOR ISLAND TERMINAL—Seattle, Wash.: The Puget Waterway Dock & Warehouse Co. Paper; 8 x 11 in.; pp. 62; illustrated.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

St. Louis Members Offer Substitute Plan for Unified National Body

The St. Louis Association of Members of the American Society of Civil Engineers recently held two special meetings to discuss the report of that society's Committee on Development. At the first meeting the details of the report were discussed, and those parts dealing with technical activities and internal relations of the local association met with general approval, although reservations were made in certain details. Among other things the meeting refused to approve the provision that applicants must enter the society in the grades of associate or lower. The idea of a national engineering organization was unanimously indorsed, and the opinion expressed that the organization should be developed by enlarging the scope of the present engineering council.

At the second meeting, through the courtesy of Edward E. Wall, a preliminary draft of the report of the committee of the society's Board of Direction, which was appointed to review the development committee's work, was read. The meeting was unable to approve of this report in its entirety, and after a very extended discussion voiced its approval of a revised scheme for a national engineering organization, which was the personal work of Mr. Wall. In the outline of this scheme, which follows, it will be noted that, like the other plans, it provides for an organization to be dominated by the Four Founder Societies. It was worked out in considerable detail, and was approved as presenting a very practical plan of organization.

NATIONAL ORGANIZATION—COMPONENT PARTS

1. Four Founder Societies:

American Society of Civil Engineers	9,000
American Institute of Mining and Metallurgical Engineers	5,000
American Society Mechanical Engineers	12,000
American Institute Electrical Engineers	14,000

2. Local affiliations.
3. District Councils.
4. The National Council.

NATIONAL COUNCIL

The National Council to be composed of representatives from the Four Founder Societies and from the District Councils, on the following basis of representation:

The presidents and latest living past presidents of each of the Four Founder Societies to be ex-officio members not only of the National Council but also of its Executive Board; one of the presidents of the Four Founder Societies shall be elected president of the National Council; the Founder Societies shall also be entitled to additional representation on the Council, in proportion to their total memberships—one representative for the first 1,000 members or fraction thereof, and one additional representative for every additional 1,000 members or major fraction thereof—these last mentioned representatives to be selected by each society through the vote of its local sections so as to secure as equitable a geographical distribution of its representation as is possible.

Each District Council shall be entitled to one representative on the National Council for the first 500 to 2,000 members of the Local Affiliations creating it, and an additional representative for every additional 2,000 members or major fraction thereof accredited to the Local Affiliations of that district. These representatives to be selected by votes of the Local Affiliations in the same manner as members of the District Council are elected, viz.:

Each Local Affiliation in a district shall elect its member, or members, of the District Council according to a general scheme of elections, which shall be agreed upon later, and incorporated in the by-laws of all Local Affiliations. Each Local Affiliation shall be entitled to a member of the District Council for a membership of 50 to 200 inclusive and an additional member for every additional 200 members or major fraction thereof.

Local Affiliations Defined

A Local Affiliation is to be understood as an association of local engineers organized primarily for the professional improvement of its members and for the purpose of advancing the interests of the profession through taking an active part in local affairs, technical as well as civic. These must not be confused with the Local Sections of the National Societies nor understood to be the same. Membership of Local Sections is confined to persons who are members of the National Societies while the membership of Local Affiliations is restricted only by its own laws. Local Sections will continue to be as at present, concerned only with the internal affairs of their National Societies. Engineers may be, and are now, members of both Local Sections and Local Affiliations. Local Sections, as organizations, will have no representation on District Councils, but their members may belong to Local Affiliations and thus have a voice in the election of such Councils. Local Affiliations are intended to be organizations to which all engineers may and should belong, regardless of the branch of engineering under which their study and work are classified—civil, mechanical, mining, electrical or chemical. The Four Founder Societies may prescribe regulations as to the establishment of Local Affiliations and the territory allotted to each as well as defining the boundaries of districts electing District Councils; may accept Local Affiliations already in existence, such as Associated Engineering Societies of St. Louis, etc., and may encourage and direct the creation of others as may be necessary.

Executive Board

The Executive Board of the National Council shall consist of twenty members, eight of which shall be the presidents and past presidents of the Four Founder Societies, and the remaining twelve to be elected by the National Council from its membership.

Assume 120,000 engineers, 40,000 belonging to four Founder Societies; then National Council would be composed as follows:

American Society Civil Engineers	11 members
American Institute of Mining and Metallurgical Engineers	7 members
American Society Mechanical Engineers	14 members
American Institute Electrical Engineers	16 members
District Councils	40 members
Total	88 members
Executive Board	
Members from Founder Societies	8
Members elected by National Council	12

Letters to the Editor

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Don't Measure With Dollars

Sir—I note in an editorial in your issue of Dec. 25, 1919, p. 1037, under the heading "What Makes a Record," reference to the statement of the Geological Survey wherein value rather than quantity was used as the measure of cement exports. I do not place my hand upon such a statement by the Survey, but I have no doubt we have issued several such statistical statements in the past.

I am writing to tell you that I wholly agree with the position that you take and as evidence of that take the occasion to call your attention to a couple of paragraphs in something that I said at St. Louis in November.

George Otis Smith,
Director, U. S. Geological Survey.

Washington, D. C.

[The two paragraphs follow:—Editor.]

The exact measure of our contribution to the world, however, is not the dollar. Some of us with a statistical bent love to note the fact that the value of our country's annual mineral production passed the billion dollar mark in 1899, reached the two billion mark in 1907, exceeded three billion dollars in 1916, and attained five billions in 1917, and five and a half billions last year. Yet the total value of our annual output is a starting point for economic self-examination rather than a goal reached that justifies self-glorification. The dollar is a handy measuring stick, but the results it gives need to be verified; quantity and quality of commodities give the truer measure of their usefulness. As a newspaper editor recently put it: "We don't eat dollar marks—we consume production."

The reported value at the mine mouth of our coal output may be significant of wages and possible profits to the mine workers and mine owners, but it does not measure the heat units made available for the world's work and comfort. So, if we look behind the camouflage of increased prices, we see that the jump of nearly a billion and a half dollars in 1917 did not mean that our mines contributed an additional 42 per cent to the world's needs. As a matter of fact, of such essential metals as copper, iron, and lead as well as gold and silver, there was a decreased output, a loss to the world, aggregating more than half a million tons. Again, last year the half billion dollar increase in market value expressed not an increase but a decrease in tonnage of such leading items as iron, lead, zinc, gold, and silver. In short, the number of loaded freight cars that daily leave your plant gives a good measure of your usefulness to the world, irrespective of the size of your daily bank deposit.

Indorses Free Employment Service Given by Colorado Society of Engineers

Sir—It is with surprise that we read in your issue of Oct. 30-Nov. 6, 1919, p. 831, the letter of S. Sergeant Newbury, president of the Business Men's Clearing House, an employment agency of Denver, with reference to the free employment agency conducted by the Colorado Society of Engineers. We believe Mr. Newbury's animus to be caused by the thought of the future rather than by any present indignation. The paragraph referred to by him and to which he takes such violent exception, may perhaps be news in fact or Mr. Newbury would possibly not have deemed it necessary to word his distaste so strongly.

The point we wish to emphasize is that the Colorado Society of Engineers has as one of its objects the establishment of a free, efficient and worthy employment service, run by men trained in engineering work—a

bureau that will reach all engineers, regardless of their affiliation with this or that organization, and render to them a personal service, free from the burden and humiliation of an excessive fee for that service.

In conclusion, let us say that when employers of engineers fully realize that such efficient and disinterested employment service is in the field to stay, we believe that they will find it of advantage to their work to patronize it to the fullest extent. The wonder is that private, self-interested employment agencies, charging excessive rates for mechanical services, are able at all to recruit workers of the grade of general intelligence expected of the engineering employee.

W. M. McMECHEN,
Denver, Colo. Colorado Society of Engineers.

Need Rigid Laws To Save Highways From Overloaded Motor Trucks

Sir—There has grown up within the last two years an abuse of highways which will cause the utter destruction of our growing system in a very short space of time unless it is handled adequately and immediately. Owing to the greatly increased use of motor trucks in recent years, they are operated largely by people who are unfamiliar with the characteristics of these vehicles and their relation to the road-beds over which they run. The greatest abuse that the highways are subject to at the present time is gross overloading of the motor trucks which utilize them. Owing to the fact that most of the motor trucks operated in this country are comparatively new, coupled with the ignorance of owners as to the extremely detrimental effect of overloading, this practice has grown by leaps and bounds to a degree which never existed before the war.

It is unquestionably the case, having been proven many times, that overloading will wreck a motor truck in a very short time. and although the initial earnings derived therefrom are very attractive, the net result over a period of years will lead to extremely heavy financial loss to the owner of the trucks. However, insofar as his personal welfare is concerned, that is solely his own affair. The highways, however, are built at the expense of the general public, and their financial damage is much greater than that which occurs to the trucks, great as that may be. And there is the additional detriment that the man who causes the damage is not heavily penalized for his abuse of the highways.

The remedy for this situation is quite plain. Many states and municipalities in this country have well-defined laws controlling the maximum weights which may be placed on motor trucks. In most instances the law even stipulates the weight per inch of tire width. But, to the best of my knowledge, in no state is any concerted effort being made to inforce these laws.

The writer owns and operates a large fleet of motor trucks, and realizes how tremendously serviceable the motor truck is in our advanced stage of civilization. He realizes quite fully, however, that misuse of motor trucks, and an abuse of the public highways which make it possible to operate them will, ultimately, be extremely disastrous.

Would it not be possible, therefore, to invite your co-operation in suggesting to the various municipal and state highway authorities to inforce the laws which have been so carefully formulated, to the point of conserving our highways for their proper usage? Even the most selfish motor-truck operator must realize by abusing the highways through overloading, speeding and undertiring, the highways immediately deteriorate, that his business experience will be most disastrous.

GEORGE H. PRIDE,
New York City. Heavy Haulage Company

"Holier Than Thou"

Sir—A good many criticisms of union methods have a great Pecksniffian air to one who has been through the mill. Labor unions only tried, in the main, to place a union price on a certain amount of union physical labor.

Typical of all corporations, what was it the railroads did to use in "ye goode olde days"? This: standardized brain power—a standard wage for all engineers regardless of the degree of their responsibility—a heavy construction residency in the mountains, same price as scratch work in the sage bush—same pay for all locators, experience counting for nothing. Some years ago railroad locators were needed on a certain job and experienced men were hard to find; still $175 a month was the standard wage. The reason for the scarcity was that the more intelligent men had quit and sought other work. Did the railroad raise wages because the supply was short? They did not. They hired green men at the standard wage.

Another railroad company, to avoid paying resident engineers $125 per month, called them "instrument men" at $100 for the same work and the same responsibility—a resident engineer in charge of construction dubbed "instrument man." It is an old story to old-timers, but all this "holier-than-thou" attitude toward labor is foolish in the extreme.

The engineer, by and large, is a skilled laborer and if he is going to get a higher wage for his commodity he will have to follow the example of the packers, Standard Oil, the steel trust, the plumbers and brick layers, and other high-class sellers of their own wares. They are in possession of the industrial secret that, given control of the supply, the demand will take care of itself. The old law of supply and demand is only for the use of the uninitiated.

If there is any Moses in the engineering profession, a man who can raise wages, a man who can talk facts and actual conditions, a very respectful hearing awaits him.

F. W. HARRIS.
Olympia, Wash.

Should All Engineers Be Engineers?

Sir—Some months ago I addressed an open letter to the *Engineering News-Record* adding a thought to the much-discussed subject of compensation for engineers. This letter was in answer to that of a young man whose engineering aspirations had been somewhat dampened through his association with underpaid engineers during the war.

In response to this published letter I have received from all sections of the country, and even Scotland, appeals from graduates and others not long in practice, asking for friendly advice on how to break the limitations of environment and get into the open field of trade and competition.

These letters are full of human interest. I say "are" because these letters still exist, and will always be among my prized possessions. You will see why later.

They have come right from the hearts of men thoroughly disgusted and dissatisfied with their results in the engineering profession, and who are groping for a chance to expand and do something with greater possibilities for them. They seem to feel that they are merely moving parts of a machine—essential to proper functioning, but limited in their spheres of personal activity and opportunity. They feel within them vibrant power, a tremendous potential force, which is fuming and fomenting for outlet. They feel they have a mighty stride, but their limiting conditions hinder their progress to mincing steps.

I have religiously answered every one of these letters, and would like to hear from more men similarly situated, for the advice I have passed on to a few has been acted upon. Some days ago I received a grateful note from one of my Southern correspondents stating that he had followed my suggestions and in four months had doubled his former salary, founded a home, and felt that at last he had "hit his stride"

Right here is a good time to bring out a thought which may encourage further suggestions: How many are trying to be engineers, who should be something else?

Many a lawyer would make a better mechanic, and likewise hundreds of half-hearted engineers, struggling and striving, would find their gait in another field. This conclusion was vividly impressed upon me a few days ago. When talking with one of my salesmen I found that previous to his entrance into sales work he had been a sad failure in contracting and engineering. He is a natural salesman, and gives promise of being a headliner in production with our company.

In this connection, and as a specific remedy, why not recommend to our colleges that every freshman on entering and registering for a course be required to go before a committee competent to make a vocational analysis to determine the student's native qualifications and inclinations for the course outlined and for the life work he proposes to follow. No rules for analysis would prove infallible, but, on the average, a large number of misfits would be started on the road to pronounced success.

I would like to have some suggestions from your college correspondents. My own experience prompts a very intense interest. WILLIAM S. MILLER.

Cleveland, Ohio. The Lakewood Engineering Co.

Ottawa Society Gets Good Publicity

Sir—I note in your issue for Nov. 27, 1919, an interesting account of the publicity methods adopted by the local chapters of the American Association of Engineers. This matter has received considerable attention from the Ottawa Branch of the Engineering Institute of Canada, and it might be of interest to some of the local engineering societies in the United States to know the methods which are adopted by this branch to obtain publicity for monthly luncheons.

The usual method is to have an editorial in one, or both, of the local morning papers to appear on the day of the luncheon, to call attention in a general way to the subject to be discussed, this is followed the next day by a full report of the meeting. Very good results have recently been obtained, as may be seen from cuttings of the Ottawa *Citizen* giving the editorials and reports of the last two luncheon meetings, held Dec. 4 and 18, 1919.

The first was a "military luncheon," the guest of honor being Maj. Gen. Sir Edward Morrison, commander of the Canadian Artillery Corps in France.

The second was a "naval luncheon," the guests being the officers of Lord Jellicoe's staff now touring the Dominion and the leading Canadian naval authorities, including Admiral Sir Charles Kingsmill, director of the Canadian Naval Service. This second luncheon was also noteworthy on account of the important speech made by His Excellency, the Governor General of Canada, who is an honorary member of the institute, on the future naval policy of the empire.

M. F. COCHRANE,
Branch Secretary,
Engineering Institute of Canada, Ottawa Branch.

[Inclosed with the foregoing letter were two postcards each bearing printed details of one of the meetings, and clippings of one of the editorials and two of the stories reporting the meetings. The editorial was given 7 in. of space in the Ottawa *Citizen*. Each of the stories, in the same newspaper, filled two columns and carried double-column heads.—EDITOR.]

Forests, Snow and Water-Supply

Sir—The article on "Determination of Water-Supply from Snow Fields," in your issue of Oct. 23, contains some very valuable figures on snow densities concerning which field data have heretofore been lacking.

The water equivalent per unit volume of snow, called "density," is given in Table I for depths from 10 to 160 in. and altitudes from 5000 to 9000 ft., during mid-winter and early spring, and embraces the results of several thousand determinations on the Sierra Nevada Mountains in Nevada. These data, in addition to their general intrinsic value, throw some very interesting sidelights on the much-discussed question of the influence of forests on water-supply. If one will average all the columns headed "Density" in that table he will find that the average density of snow in the open was 42.4%; average density of snow in thin forest 41.1%; average density of snow in dense forest 38.0%.

This means that snow in the open stored practically 12% more water than equal depths in dense forests. It is also well known that depths of snow in the open at the beginning of spring are from 10 to 20% greater than in the forest (see *Journal of Electricity*, March 15 and July 1, 1919). Hence it appears that the open country has a greater water-storage capacity than the forested area by from 20 to 30 per cent.

In other words, the forests have the effect of dissipating a large per cent. of the total snow fall. The reason for this is obvious when we consider that the trees catch a large portion of every snowfall and hold it until evaporated, the evaporation in inches of water depth from snow being several times that from a water surface. The portion thus dissipated is lost to the water-supply of that region.

In localities where the entire supply is reservoired for irrigation, as in many sections of the West, the *total supply* is the all-important factor, since the extent of agricultural areas is limited thereby. In such localities we must value the forests for timber, grazing, recreation and aesthetic qualities on the positive side, and for their water-conserving facilities on the negative side. J. C. STEVENS.

Portland, Ore.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Horses Roll Large Concrete Pipes

ROLLING large concrete pipes by horses, and placing them by means of a dragline excavator, were methods used in construction of a land-drainage system north of Worthington, Minn. The length of haul was from 100 to 600 ft., over low, wet ground where trucks

HORSE HAULS 42-INCH CONCRETE PIPE

could not be operated. Each pipe section was 42 in. in diameter and 36 ft. long, weighing 1970 lb. and hauled by one horse, as shown in the illustration. Two chains hitched to the middle of the singletree were attached to the ends of a wooden roller placed inside the pipe, one chain being hooked to the roller and readily detached. The chains carried also a smaller roller in front which served to prevent the pipe from rolling when the horse stopped or was going down grade. the slackening of the chain causing the roller to drop.

This method effected a large saving in labor cost, as four men could not roll the pipes over soft ground, while one man could handle two horses and pipes. As the ditch was made with a dragline machine having a 50-ft. boom this machine was used also to pick up the pipes by a chain sling with hooks and swing them into place. The contractor for this work was the McCracken Concrete Pipe Co., Luverne, Minn.

Winter Construction of Steep Pipe Line

A TEN-INCH pipe line, 2,088 ft. long on a grade of about 45 per cent, with two to seven ft. of snow on frozen ground, was built without special discomfort except in connecting the flange joints during zero weather. This was in the Selkirk mountains, British Columbia, and was for a hydro-electric plant. The first 960 ft. had a grade of 41 per cent, then 730 ft. of 42.9 per cent and the remainder 45.6 per cent. Spiral riveted pipe with forged-steel flanges was used for the 960-ft. stretch. This included 390 ft. of 9-in. pipe of No. 12 gage, weighing 420 lb. per 30-ft. length; 300 ft. of 10-in. No. 12 pipe weighing 450 lb., and the remainder 10-in. No. 14 pipe weighing 330 lb. per length. Beyond this was 10-in. and 12-in. wire-wound wood-stave pipe weighing about 240 lb.

Each pipe was carried on two 2-ft. sleds and was hauled by two teams hitched to the forward sled. For about 400 ft., however, with a grade steeper than 45 per cent, it was necessary to use a single block and tackle. This distribution of the pipe required two teams and three to four men for 14½ days and cost 15c. per lineal foot. Trenching to a maximum depth of 10 ft. was required, as the flanged connections did not permit of much bending of the pipe line. A 35-ft. length was excavated and when a pipe section had been laid and connected it was covered with material from the next length of trench. Grade was given by a carpenter's level and a wood triangle.

Tunnels were used occasionally where the depth was over 7 ft., in order to avoid digging through the snow and the frozen moss and soil. On this steep grade it was easy to throw the dirt from the tunnel over the preceding length of pipe. Before lowering the pipe, its rear end was heated in a stove to remove all snow and ice which would interfere with making the flange joint. Excavation was in cemented glacial drift, with few boulders larger than one-man size. The 361 cu.yd. cost $2.40 per yd., although in summer it could have been done by contract for 96c. per yard.

Trestles 1 ft. to 16 ft. high aggregated 1,100 ft., requiring 18,320 ft. b.m. of round timber, cut and hewed on the ground. Bents were spaced 10 ft. on centers. Sills and caps were hewed on two sides. No timbers had to be carried more than 80 ft. On account of almost continuous snowfall the pipe was laid as soon as two or three bents were constructed. Trestle construction, including cutting and hewing of timber, cost $3.64 per 1000 ft. b.m. The cost of laying the entire pipe line was about 14c. per foot. Wages were $5 per day and board, except that the foreman received $6. This work was described in the *Engineering and Mining Journal* of Nov. 22-29, 1919, by William W. Elmer, Portland, Ore.

Railway Fill Made With Stiffleg Derrick Dragline

TWO stiffleg derricks converted into dragline excavators have completed 65,000 cu.yd. of railway embankment for the Miami Conservancy District at a cost of 26.7c. per cu.yd. The embankment was 1½ miles long across flat land and the converted derricks

TWIN DERRICK DRAGLINES BUILD RAILWAY EMBANKMENT

worked as shown by the illustration, one on each side taking material from parallel borrow pits. An advantage of the machines, as compared with other forms of grading equipment ordinarily employed, was their ability to excavate below the ground water line, which, on these flat lands, was only 3 ft. below the surface.

Both derricks were originally of timber construction and had 12-ft. ball wheels, about 9 x 10 in., 3-drum hoists and 4½ x 5-in. swing engines with 4 x 8½-ft. vertical boilers operating at 100-lb. pressure. One cost originally $4,300 and the other $4,000. The timber booms were removed and replaced by steel booms, 62 ft. long and made from the stifflegs of a steel derrick which had been re-equipped. For embankment work machines were mounted on 30 x 30-ft. frames and traveled on 8-in. rollers on timber ways about 18 in. high.

Due to rather heavy work pulling stumps and to originally too-small cables and too-light ironing, breakages were rather frequent, as indicated by the cable bill of $1,405 and the bill of $628 for replacing sheaves.

Operation of the draglines proper required 1 foreman, 2 dragline runners, 2 firemen, 1 pumpman and 8 laborers—14 in all. In addition, 2 to 3 men were kept on the embankment dressing the crown and slopes. The working day was 10 hours, of which a 2-hour loss, due to stoppages for repairs, oiling, moving ahead, etc., was considered normal. The job took about four months. Operating expenses were as follows:

Shop repairs, $2,407.33; labor, $13,331.14; materials (cable, coal, etc.), $3,062.80; field accounting, $220.96; hauling draglines Osborn to Dayton, $216.96; Dayton garage, $8.42; total, $19,247.61.

The total material moved was 65,000 cu.yd., giving an operating cost per cubic yard of 29.6c. Deducting time lost for retubing boilers and cost of repairs of same, these items not being fairly chargeable to the job, reduces the cost to 26.7c. This represents a contractor's cost, with materials, repairs and labor obtained in the open market, and no overhead except for field accounting.

This work was performed by force account by the Miami Conservancy District, Arthur E. Morgan, chief engineer, Charles H. Paul, assistant chief engineer, and C. H. Locher, construction manager.

Plank Covering Protects Steam Shovel from Blasts

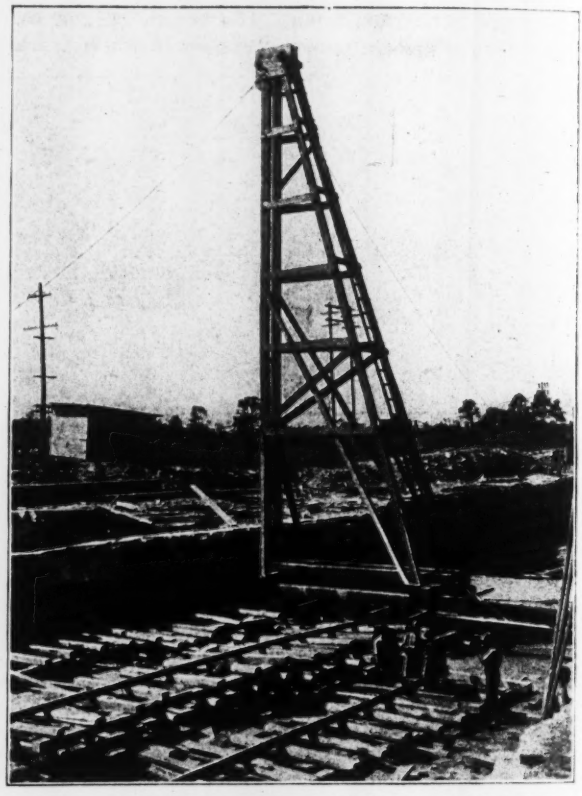
IN EXCAVATING a power-house site in solid rock, the Joaquin Light & Power Co. of Fresno, Cal., is using a steam shovel operated by compressed air for loading dump cars. The blasting is frequent and it is not convenient to get the shovel into shelter for each shot. Accordingly, the stack was removed, a timber frame was built up around the boiler and planking was put on the top and the sides for protection from flying rocks.

HOUSING SHIELDS SHOVEL FROM FLYING ROCK

When the blast is ready the shovel is left wherever it is working after swinging it around so its boarded-up end is facing the blast. No damage to the shovel has resulted, although the 2-in. planking has been smashed in several places, as the picture shows.

Submarine Drills Mounted on High Frames For Land Work

FOR the rock excavation at the lower end of the Queenston-Chippawa power canal, the Ontario Hydro-Electric Power Commission has installed a number of submarine drills mounted on high frames similar in design to a pile-driver rig. The section to be excavated is in the Niagara limestone and is rectangular, 48 ft. wide and varying in depth from 40 to 60 ft. The upper 10 ft. of the faces is cut with channelers, but below that the drilling from top to bottom is done with submarine drills, of a maximum diameter of 4½ in. and a minimum of 2 in.



PILE-DRIVER RIG CARRIES SUBMARINE DRILL FOR LAND WORK

Each drill is carried in the 55-ft. leads of the rig from the main line of a hoist mounted on the platform behind the leads, a spare line on the spool being used to elevate the drill steels when required. The frames are mounted on skids or rollers, as shown in the view of one on which the drill has not yet been mounted. Five of the drills are working across the 48-ft. cut, two as close as possible to the face and the other three spaced equally in the intervening space.

Civilians on Port Facilities Commission

Inadvertently the statement was made in ENGINEERING NEWS-RECORD, Jan. 1, 1920, p. 43, that the Port and Harbor Facilities Commission of the United States Shipping Board of the United States Shipping Board was made up "mainly" of Army and Navy officers. While the chairman, vice-chairman and chief engineer are in the Army and Navy, the other six members are railway, shipping and transportation experts.

NEWS OF THE WEEK

New York, January 15, 1920

Agree on Six Months' Extension of Federal Rail Guarantee

While no agreement has been reached by the joint committee of the Senate and House, at this writing, on the more important points of difference of the Esch and Cummins railroad bills, the confreres completed agreement on Jan. 9 continuing the standard return to the railroad corporations for a period of six months after the termination of Federal control, and providing a $300,000,000 revolving fund for the purpose and from which carriers will be permitted to borrow temporarily.

Last week a split occurred in the ranks of the railway executives when Daniel Willard, president of the Baltimore & Ohio, Howard Elliott, president of the Northern Pacific, F. D. Underwood, president of the Erie and others opposed the stand taken by A. P. Thom, general counsel of the Association of Railway Executives, against the rate-making provisions of the Cummins bill limiting "excess" earnings. Disagreement regarding this feature of the legislation followed a meeting called by Mr. Thom to oppose these portions of the bill. Judge R. S. Lovett, chairman of the Union Pacific, appears to be leading the fight against the limitation of earnings as now proposed.

On Jan. 8 representatives of the National Grange, in an interview with Senator Cummins of the Interstate Commerce Committee, "presented the views of the farmers" asking for a prompt return of the railroads and strongly urging the retention of anti-strike clauses of the Cummins bill. On Jan. 9 the National Industrial Traffic League, representing a large number of shippers, addressed a telegram to the confreres advocating the elimination of all reference to a Transportation Board, favoring anti-strike legislation and "unalterably opposed" to fixing minimum or maximum rate of return and limiting "excess" earnings.

No Great Enlargement of Bureau of Public Roads

(*Washington Correspondence*)

It has become widely circulated that legislation is being considered providing for an immediate enlargement of the Bureau of Public Roads. This is not the case. As the Federal-aid activities increase there naturally is a gradual growth taking place in the Bureau of Public Roads. Forty-two per cent of the bureau's personnel was in the military service during the war. This gave rise to the greatest difficulties in handling the bureau's work during the war period, but most of its experienced men have returned and its work is now being conducted on practically a normal basis. Closer contact with the state highway departments is being established by the stationing of representatives of the bureau in various state capitals.

Chief of Engineers Recommended But Identity Withheld

The Secretary of War has let it be known that he has made his recommendation to the President for the new Chief of Engineers. He declines positively to state whose name went forward. Owing to the illness of the President there has been considerable delay in forwarding nominations to the Senate for confirmation and it is possible that some time may elapse before the name of the nominee for Chief of Engineers becomes known. On the other hand, due to the importance of the position, it is possible that it may go to the Senate any day.

Revised Townsend Highway Bill Discussion Soon

(*Washington Correspondence*)

No plans yet have been made for hearings on the revised Townsend Highway Bill. Senator Townsend's presence in Washington has been prevented by the death of Mrs. Townsend. It is believed, however, that the opening of hearings will not be delayed greatly, and that active attention on the part of the Senate Committee on Post Offices and Post Roads will be centered in the near future on the bill which has as its main objects the construction of a national highway system and the creation of a Federal Highway Commission.

Census Asks Strike Loss Data of Manufactures

In gathering information for the census of manufactures the blanks now being mailed by the Bureau of the Census contain, for the first time, an inquiry intended to disclose losses caused by strikes. A paragraph was included in the questionnaire at the request of the National Association of Manufacturers which will not only show the direct economic loss sustained by industry and the country on account of strikes and consequent interruptions of production, but of indirect losses as well. This latter will include, for example, a plant which is closed on account of the coal strike and could not operate for the reason that fuel was not available. It is expected that the compilation of accurate figures as to losses from strikes will furnish the public with impressive information in that connection.

Engineering Council Asks Contributions

$45,000 Needed To Carry Out Program Planned for 1920—Statement Cites Work Done and in Progress

Engineering Council's need of $30,000 in excess of the $15,000 expected from the engineering societies and its belief that the benefit of its service to the engineering profession is so appreciated as to render certain the receipt of that amount in general contributions, are presented in a statement outlining its accomplishments and plans. The statement, issued over the signature of Council's secretary, Alfred D. Flinn, follows:

"Engineers of the United States evidently want such services as Engineering Council has been rendering for two years and a half. Many expressions of appreciation have been received. Desires for larger and more varied services are frequent. Council's member societies have provided for it as liberally as they could from their treasuries; but as Council's services are not limited to the 41,000 members of these societies, and as the incomes of the societies are not adequate to all the needs, it was recently decided to give engineers throughout the country an opportunity to contribute individually to the financial support of the Council, thus showing the measure of their earnestness in desiring the enlargement of the work. Letters have been sent to 50,000 engineers to meet the present emergency.

"In appealing for support Council presents the following partial statement of work done and in progress:

WORK DONE AND IN PROGRESS

Held organizing meeting June 27, 1917.

Furnished the Government 4,000 names of engineers for war service.

Engineering Societies Employment Bureau since the armistice, has registered 5,000 engineers and assistants (mostly returned soldiers and sailors) and aided thousands of them to positions, at no cost to the individuals, but at an expense of more than $15,000 to Council's member societies.

Aided Naval Consulting Board and Army General Staff in examining 135,000 suggestions and inventions for war devices.

Assisted Fuel Administrator and Bureau of Mines in fuel conservation.

Helped secure exemption of engineer students from military service until completion of technical training.

Opposed "anti-efficiency" proposals in bills before Congress.

Supplied Congress information about waterpower; is working on other water conservation problems.

Aided in organizing National Federation of Construction Industries.

A Washington office has been maintained since Jan. 1, 1919, in charge of M. O. Leighton, chairman, National Service Committee, giving a varied service to engineers, especially in supplying information concerning congressional and department activities, also useful to Government.

Assembled in Chicago, in Apr. 1919, a conference of 74 technical organizations having 105,000 members. This conference, permanently organized, drafted the Jones-Reavis Bill, and is advocating its passage

(*Concluded on v.* 156)

WASHINGTON BRIEFS

Preparatory to turning back the railroads, the Railroad Administration has ordered a general material inventory to be taken as of Feb. 29.

Technical education for Army officers is one of the matters being discussed at a conference of department and division commanders with the War Department, which began Jan. 12.

Frank P. Trott of Arizona has been nominated by the President to be Surveyor General of Arizona. Gilman Bullard of Helena has been nominated for the same position in Montana.

Construction division contracts originally amounting to $8,354,283 have been settled for $2,257,912, the War Department reports.

On the reconvening of Congress after the recess, an effort was made immediately by Senator Calder of New York to bring up the bill providing for a zone system to regulate the height and use of buildings in Washington. The measure was blocked, temporarily at least, by Senator Thomas of Colorado, who objected because the bill creates another commission.

The hearings on the bill which recently passed the House, providing for the abolition of the United States Housing Corporation, were begun by the Senate Committee on Buildings and Grounds Jan. 12.

The Interdepartmental Board on Survey and Maps set up a permanent organization Jan. 13. The headquarters of the Board is in an office in the Interior Building.

Report on Proposed Harbor at Hamilton, Ontario

John M. Wilson, district engineer, Public Works Department of Canada, who has charge of the Central Ontario District, has just made a report to the Hamilton Harbor Commission on a proposed development of the Port of Hamilton, Ont. The city now has a population of 110,000, but is growing very rapidly, particularly in its industries. The proposed harbor scheme is intended to take care of the growth of the city for a number of years to come, but has certain provisions for early construction. The proposition resembles very much the new harbor development at Toronto, and shows the influence of the Toronto harbor engineers who acted in an advisory capacity. It provides, in general, for ships drawing 30 ft. of water to dock in slips on the present shore line and along wharves constructed out into the harbor, the reclamation of considerable of the inner harbor area by dredging which will deepen the central harbor, service of the industrial lines with cheap electric transportation concentrated on a marginal way, and the creation of park lands, recreation centers, and a boulevard drive around the entire water front. The completion of the work would leave Hamilton harbor with an area of 4380 acres or 6.8 square miles, having a governing depth for navigation of 30 ft., compared with the present 4500 acres having a depth of 18 ft. There will be added 1250 acres of park and residential property, 1198 acres of land suitable for industrial purposes, and 6.26 miles of docking accommodations. The sum required for immediate consideration is about $4,500,000, which it is suggested should be apportioned among the Dominion Government, the City of Hamilton and the Hamilton Harbor Commission, after the same general scheme which was followed in Toronto.

George Eastman Is Technology's Mysterious "Mr. Smith"

The general curiosity concerning the identity of the so-called Mr. Smith who offered the Massachusetts Institute of Technology a $4,000,000 endowment, conditioned upon its acquiring another equal amount, was satisfied at an M. I. T. alumni dinner in Boston, Jan. 10, when George Eastman, Kodak multimillionaire, was announced as the donor.

At the time of the dinner the amount needed to match the gift of Mr. Eastman had been raised by those working for the M. I. T. endowment fund, and the announcement there that Mr. Eastman had made good his promise was cheered to the roof. Mr. Eastman's present gift to Boston "Tech" raises the total of his presentations to the sum of $11,000,000.

General T. Coleman du Pont, president of the Alumni Association, presided at the dinner and was one of the principal speakers. Other speakers were Frank A. Vanderlip, Otto Kahn, Theodore N. Vail, Matthew C. Brush, Charles A. Stone, E. S. Webster, W. C. Potter, Charles Hayden.

Shipyards Sold and Leased

Two sales of wooden shipyards are reported from the Puget Sound region. Supple & Martin have bought the Columbia Engineering Works wooden shipyard at Linnton, Ore., from the receiver of the yard. This yard was closed last July on account of financial trouble. It is said that the new owners intend to use it for building barges, wooden schooners, and sailing vessels, small steamers, and ship supplies. The Sanderson & Porter yard at Raymond, Wash., has been sold by the Emergency Fleet Corporation.

In the East an important transaction was completed on Jan. 9 by the leasing of the Newark Bay shipyard (agency yard) to the Submarine Boat Corporation for four years from Nov. 15 past. The total rental is $4,000,000. The right to buy the site from the City of Newark is included. The Emergency Fleet Corporation also agree to continue the contracts for all except 32 of the 150 vessels which the yard was planned to build. At the same time the Submarine Boat Corporation buys the steel for the 32 ships canceled, at one-half its cost raw, plus the cost of fabrication.

Detroit Has Consulting Committee for Big Sewer Program

Following the recent action of the Detroit City Council, authorizing the Commissioner of Public Works to appoint a sewer commission to act with him in an advisory capacity in carrying out the city's sewer program, a committee of three engineers and two contractors has been selected. The men named are: W. S. Kinnear, consulting engineer of Detroit and New York; Prof. William C. Hoad, Sanitary Engineering Department, University of Michigan; E. D. Rich, State Sanitary Engineer of Michigan; George R. Cooke and J. A. Mercier, Detroit contractors.

Owing to the fact that public work was halted to a considerable extent during the period of the war, and also that Detroit in that time experienced an unprecedented growth, it is deemed necessary to carry out a sewer program in 1920 involving expenditures of about $1,000,000 a month. It is believed by the Commissioner of Public Works that a bond issue should be voted to provide funds for the new sewers, since the usual annual appropriation, which could not be materially increased, would necessitate spreading the needed sewer improvements over a period of several years.

In letting contracts recently increasing difficulty has been experienced in getting satisfactory bids as the contractors bid very high to protect themselves from the increasing cost of labor and material. The question of the availability of lump sum bids may result in the devising of a new kind of contract.

The work proposed for 1920 is part of the extensive sewer system planned for the City of Detroit by City Engineer Clarence W. Hubbell.

Spruce Production Division Sells Remaining Equipment

The remainder of the unsold equipment of the United States Spruce Production Corporation was disposed of recently at an auction sale. The equipment has been stored in the cut-up plant at Vancouver, Wash. The plant has been used since December, 1918, as a central assembly point for all equipment shipped in from other cities and woods camps. The methods of handling the very large stocks assembled there was described in *Engineering News-Record* of May 15, 1919, p. 967.

Nothing remains unsold at the Vancouver yards except the buildings, and these may be taken over intact by the War Department to be used in connection with Vancouver Barracks, located nearby. The properties of the Corporation which could not be collected at one point, such as railroads, mills, etc., have not all been disposed of, but negotiations are well along toward conclusion for most of these. A small staff of officers is still located in Portland closing up affairs.

I. C. C. Hears Arguments on Valuation Principles

Interpretations of Act Applying to Pending Decisions Presented by Parties at Interest

(Washington Correspondence)

Parties at interest in the physical valuation of the railroads by the Interstate Commerce Commission presented oral arguments before the full membership of the Commission, in Washington, Jan. 6-8, regarding the interpretation of the Valuation Act with particular respect to pending decisions, as in the Kansas City Southern case and the Texas Midland case, in which a tentative valuation was reported without fixing a single sum as the value of the property. Counsel appeared in behalf of the Railroad Presidents' Conference Committee, the Kansas City Southern R.R. and other carriers, and the National Association of Railway and Utilities Commissioners, as well as the Interstate Commerce Commission.

In October, 1916, when the Commission filed the tentative valuation of the Texas Midland, which did not contain a single sum as the value of the property, it was thought that action concerning final value should not be taken until after a comparatively large number of tentative valuations had been prepared and served and the interested parties been given an opportunity to be heard fully upon the question, according to the annual report of the Interstate Commerce Commission to Congress Dec. 1, 1919. The Commission also states that it was considered preferable that full opportunity for discussion be provided to aid in a final settlement, and hearings were arranged for Jan. 6-8 after postponement from May 27, 1919, at the request of the Carriers' Conference Committee, presented for the reason that tentative valuations had not, at that time, been served for any of the large "standard" railroads represented by that Committee. Briefs had been filed, previous to the oral hearing, by the parties at interest, including 97 per cent of all of the railroads of the United States.

In presenting the case for the National Association of Railway and Utilities Commissioners, John E. Benton, solicitor for the Association and its Valuation Committee, stated that the Commission ought not to attempt the finding of final value of a carrier in the proceedings, on the ground that the Valuation Act empowered the Commission to determine value only for the reason that its jurisdiction arises from its rate-making powers and not from the valuation amendment. Mr. Benton also emphasized the need for considering appreciation in connection with financial history for true determination of value without duplication.

P. J. Farrell, chief counsel for the Interstate Commerce Commission, concluded his argument with a statement that, at present, rate-making is the only purpose, under the act to regulate commerce, for which the Commission can use the final value of common-carrier property, but if in the future it becomes necessary to fix a final value of such property for some other purpose, any necessary modifications of the value for rate-making purposes can be made readily. Mr. Farrell also emphasized the importance of financial history in the determination of values for rate-making purposes.

In behalf of the Presidents' Conference Committee of the Carriers, W. G. Brantley said, "There exists in a railroad property a structural value determined by the cost of reproduction method, the amount of which is not affected by the raising or lowering of rates while the intangible values, based in part upon net earnings, are influenced by the fluctuations of rates." It was also stated that the commissioners are engaged in making a report to Congress on the value of railroad properties and that Congress has directed how the report shall be made: Separate reports of the tangible and intangible elements of value in each railroad property. It was stated that the burden of proof, as well as the responsibility for making this report, rests upon the Commission and not upon the carriers and that the connection of the carriers with the making of the report is only co-operative.

As a result of the hearings it is thought that the Commission will proceed to issue statements of final valuation in the near future as rapidly as tentative valuations can be prepared, although no intimation has been given of its intentions, at this writing.

Reduce Rates on Interstate Hauls of Road Material

The New York State Highway Commission has attacked successfully the rates being charged on road building material on interstate hauls over Federally controlled railroads. In two instances the Interstate Commerce Commission has ruled that rates charged were unreasonable and has prescribed reasonable rates. The success in these cases is expected to induce similar complaints to be filed in New York and in other states. In connection with its opinion the Interstate Commerce Commission makes the following statement:

"By provision of Traffic Circular No. 9, dated April 14, 1919, the carriers under Federal control were authorized to apply rates on crushed stone, sand and gravel, shipped during the period from May 1 to Dec. 31, 1919, inclusive, when for use in road building or road maintenance, and when consigned to, and the freight thereon is paid by, state government, of 10c. per net ton less than the regularly published tariff rates in effect at the time, but with a minimum charge of 40c. per net ton. This special authorization may be applicable with respect to the rates herein found to be reasonable, but we have no authority to require it to be observed."

Contributions from the National Public Works Department Association

By M. O. Leighton, Chairman

PUBLISHER'S NOTE: *The space occupied under this caption is donated to serve as a means of frequent and intimate communication between the National Public Works Department Association and the members of the profession. The contributor takes full authority for the statements made.*

Is This a $4,000,000,000 Country?

As the public works campaign progresses it has become more and more apparent that interest in the project extends far beyond the technical fields that were represented at the Chicago conference where this campaign organization was set up and the movement took definite shape. In these days of high Government costs, which are now borne largely by direct taxation, the interest of the citizen in the efficient and economical conduct of Government business has become intensified. The big budget of nearly $5,000,000,000 sent to Congress a few days since by the Secretary of the Treasury has startled Congress and fallen wet-blanketwise on the country. Deducting about $1,000,000,000 for interest on war debt, there remains $4,000,000,000 for Government upkeep in these times of international peace.

Is this a $4,000,000,000 country? Members of Congress evidently believe not, and yet as they collectively scan the items which make up this enormous Treasury estimate it becomes increasingly difficult to choose those which shall be eliminated. Every item has its strong supporters and therefore each must have its particular merits. Who shall select those that are unworthy?

We were willing to pay the price of bad business organization and the enormous wastes resulting while we were affluent and did not feel the pinch. In former years we paid largely through tariff and indirect internal revenue imposts. This was a tax anaesthetic. Now we feel it, first because we get an annual bill for our share, and second because the bill has grown so large. Therefore, it being conceded that practically all the items in the Treasury estimate are worthy, the next step is to determine whether they should cost so much. Is there an open bunghole in our barrel?

Now comes scrutiny of our Federal business methods, and as the public-works functions constitute the largest item we have the banker, merchant, manufacturer and public utility man all properly interested in correcting a condition of business unorganization which would wreck the strongest private industrial institution that ever took form. The technical men of the coutry are therefore the pioneers in a public-works movement. Men and women in other avocations are quite as much interested.

Recognizing the foregoing premises the executive committee of this organization, at its recent meeting, laid plans for a more inclusive campaign program

by authorizing the officers to invite participation by all industrial organizations. The first step taken was to change the long name of the federation that has been conducting the campaign, and which by specific mention of engineers, architects and constructors has by inference excluded all others. This organization is now known as The National Public Works Department Association. From time to time as the industrial and commercial interest of the country are brought in representation will be given them on the executive committee.

In response to a resolution supported by a brief presented by Engineering Council, the board of directors of the United States Chamber of Commerce, has authorized the appointment of a special committee of the Chamber to investigate and report on our project for a department of public works. It is our hope that the logic and merit of the plan will so commend itself to the committee that the Chamber will be persuaded to present the matter for referendum to the member bodies throughout the United States.

CHANGES IN EXECUTIVE COMMITTEE

Charles Whiting Baker, consulting editor, *Engineering News-Record*, and a member of Engineering Council was appointed to the Executive Committee of the Association to succeed W. A. Nichols, Jr., resigned. Robert Spur Weston of Boston, Mass., was added to the committee to represent the chemical profession.

Every day brings new assurances in substantial form concerning growth of conviction among members of Congress and professional and business men as to the necessity for a National Department of Public Works. Records and resolutions reporting favorable action by professional, industrial and civic organizations are being received with almost every mail delivery. Many of the State campaign committees are accomplishing splendid results and we have yet to receive a single unfavorable expression from any of the many members of Congress who have been approached from "back home" on the subject. Your chairman knows the dangers of optimism in the appraisal of a campaign of this kind but he does not hesitate to assert that during an 18-year period of participation in and close observation of national campaigns of this nature he has never known of one in which, at a stage comparable with the present, the prospects were so bright from the legislative standpoint. He heartily wishes he could say as much with respect to financial aspects. If this campaign fails it will be because its originators justify their old reputation as to "unresponsiveness, aloofness and indifference."

Edison Award to W. L. R. Emmet

At a recent meeting of the Board of Directors of the American Institute of Electrical Engineers, the Edison Medal Committee reported that the Edison Medal for the year 1919 had been awarded to W. L. R. Emmet for "inventions and developments of electrical apparatus and prime movers."

Jewish Engineers Outline Program for Palestine Development

A preliminary program for the industrial and agricultural development of Palestine was presented in reports read to a 3-day convention of the Zionist Society of Engineers and Agriculture in New York City, ending Dec. 29. The Society is made up of members of the parent Zionist Society who are technical men and experts in industrial and agricultural lines. Its purpose is to prepare from available information a survey report of all improvements needed, and, as far as possible, their design and cost on the basis of the first 100,000 expected Jewish immigrants to Palestine following the favorable settlement of that region's political status. The report is intended to serve the parent organization as a budget guide in collecting funds for the Zionist movement.

The ambitious development contemplated in the engineering section's reports, presented by James Haines, engineering secretary, includes: Extensive water-power, water-supply, and sewage projects; the irrigation of 3,700 acres and the drainage of 5,000 acres of the Hullah Valley; the creation of modern harbor facilities at Jaffa or Haifa; building of a system of railroads and highways; temporary housing; and construction and equipment of all such industrial plants whose raw material is available and whose product will be for home consumption.

The Society's plans were designed to make the expected Jewish communities of Palestine as nearly self-supporting as possible.

To Study Ground Water in Hawaii

Representatives of the ground-waters division of the United States Geological Survey will sail from San Francisco Jan. 22, 1920, for the Hawaiian Islands, where they will make a detailed study of the ground-water conditions on the islands, with a view toward giving them a better supply of water. O. E. Meinzer, W. O. Clark and L. F. Noble will conduct the study.

The investigation has been authorized at the request of the Governor of the Hawaiian Islands, and it is believed that this survey will be one of a series to follow later, involving the geologic mapping of the entire islands, and also aiming toward increasing the water-supply at Honolulu and for the Army and the Navy.

The Governor of the islands has authorized an expenditure of $15,000 to cover the cost of the preliminary survey, to be conducted under the direction of the groundwaters division of the Geological Survey.

Engineering Council Asks Contributions

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for the establishment of a National Department of Public Works, by modification of existing departments. Chamber of Commerce, U. S. A., has been petitioned to submit this project to referendum of its members.

Conferences of the fourteen Government offices engaged in map-making have been brought about through an appeal to the President, with prospects of greatly accelerating completion of the topographical map of the United States.

Aided in securing increases of pay for railway technical engineers.

Committee on Classification and Compensation of Engineers, with sections on railroads, Federal Government, and municipal and state governments, is getting results. Is working with Congressional Joint Commission on Reclassification of Salaries.

Aided in reinstatement of 350 engineers unfairly dismissed by City of New York.

Recently organized a Committee on Types of Government Contracts.

Drafted a typical general law for registration of engineers.

Requested the President to appoint engineer members of the Interstate Commerce Commission and of the International Joint Commission.

Assisted the State of New York in preparing a scheme for reorganization of state government.

Is studying curricula of engineering schools, making suggestions as opportunity offers.

Joined with National Research Council in a report on improvement of the patent system and practice, on which legislation has been based.

Participated in organizing the National Board for Jurisdictional Awards in the Building Industry and has a member thereon.

On invitation of the House of Representatives committee, sent delegates to present testimony on a national budget.

Engineering Council has 40 general correspondents and 27 correspondents of its Water Conservation Committee, distributed throughout the country. It has 22 committees, of whose 125 members 72 live at a distance from New York.

MORE FUNDS NEEDED FOR GREATER WORK

Larger resources are needed for continuing and enlarging the work of Engineering Council. Let every Engineer help!

Council needs not less than $45,000 for 1920, and of this sum at least $30,000 must come from general contributions.

EXPECTED INCOME FOR 1920

From four founder societies	$12,000
From other member societies	3,000
From general contributions	30,000
Total	$45,000

PROPOSED EXPENDITURES FOR 1920

New York office, salaries, postage, printing travel, and general expenses	$12,000
Washington office, similar items	12,000
Committee on Classification and Compensation of Engineers	10,000
Other committees (see foregoing statement of work done)	5,000
Contingencies (new work and unforeseeable expenses)	6,000
Total	$45,000

For 1919 the total income was $50,000, including $25,000 advanced by Chairman Channing and not yet repaid. The expenditures have been:

New York office—salaries, equipment, travel, postage, telegraph, telephone, printing and miscellaneous	$7,500
Appeal for funds for 1920	2,000
Engineering Societies Employment Bureau	13,500
Washington office (including promotion of National Department of Public Works)	25,000
Committee on Licensing Engineers	1,000
Committee on Classification and Compensation of Engineers, and other committees	1,000
	$50,000

"Those desiring to contribute to Engineering Council are requested to make checks payable to United Engineering Society, 29 West 39th St., New York City. United Engineering Society is the organization created by the Founder Societies (the Civil, Mining, Mechanical, and Electrical engineers), to administer certain property and funds for joint activities."

Insurance, Pensions and Sick Benefits for Canadian Hydro Employees

Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, has announced that a plan providing pensions, insurance and sick benefits to the employees of the Commission has been formulated and will be put into effect as of Nov. 1. About 2,500 employees will be affected, although only the sick benefit provisions of the plan will apply to female employees. Pensions and insurance will be available to men after fifteen years of service with the Commission.

Pensions will be paid to men when they reach the age of sixty-five, or before that age if permanently disabled. The amount of pension to be granted will be one-eightieth of the recipient's average pay for the last five years before his retirement, multiplied by the number of years employed.

The insurance plan provides for the payment to the estate of a male employee, upon his death, of a sum amounting to 5 per cent of his salary for each year he has served, provided that it does not exceed twice the current salary. The sick benefit, which will apply to permanent employees of both sexes, stipulates that any person incapacitated by illness will be carried on the regular pay list for one week and thereafter transferred to and carried on the benefit list. The scale of sick benefit payments has not yet been fixed.

In formulating its plans the Commission assumed that, due to marriages, very few of the female employees would complete the fifteen years of service required for pension and insurance, and a special savings scheme has been arranged for them. A savings account will be opened for each woman in which will be deposited every year 5 per cent of her year's salary. When she leaves the service she will be paid the accrued amount. The cost of all benefits granted its employees will be paid by the Commission.

Lectures on The Social Function of the Engineer

The New School for Social Research of New York has arranged for a series of weekly lectures on "The Social Function of the Engineer," to begin Feb. 2 and be given each Tuesday evening thereafter for twelve weeks at the school, 465 West 23d St., New York City. The course will be conducted by Guido H. Marx, professor of mechanical engineering at Stanford University. The theory upon which the course is based is that the production and distribution of goods is now fundamentally an engineering as well as a social problem. The engineer's function is to insure the full use and unimpeded operation of the material resources and industrial equipment of the nation, with a view to secure a larger volume of production and a more adequate distribution of the output. The course will be directed primarily to technical men, and its purpose will be to reach a common understanding of the existing industrial and social problem. The fee for the course is $20.

The New School of Social Research at which this course will be given was founded last year by a group of men who believed that there was educational need for an institution of the kind. Its purpose is to supply instruction of a "post-graduate" character, although an academic degree is not required for admission. There is no grant of degrees.

The list of instructors includes Robert Bruère, Thorstein Veblen, Charles A. Beard and John Dewey, while among the directors are Herbert Croly and Alvin Johnson of the *New Republic*.

Col. L. H. Beach To Be Chief of Engineers

A dispatch from "Engineering News-Record's" Washington correspondent, received just as this week's issue was going to press, states that the President will nominate Col. Lansing H. Beach as Chief of Engineers U. S. Army.

American Contractor Has Large Building Jobs in Peru

Contracts for the construction of several government buildings, a large cathedral and a number of apartment houses and housing groups in Lima, Peru, have been awarded to an American construction firm, the Fred T. Ley Co. The company's contracts with the Catholic Church, the Peruvian government and the housing interests are said to run into several millions of dollars.

Nearly all the structures will be of reinforced concrete and all skilled labor for the work will be taken from the United States. The Fred T. Ley Co. has its main office in Springfield, Mass., and branches in Boston, New York City, Buffalo and Philadelphia. It is understood that it has a very large construction organization and that nearly the entire force will be sent down to execute the South American contracts.

Navy Engineering Classes Resumed

As another step toward the return to former peace conditions the Navy has resumed the pre-war custom of training part of the Annapolis men in advanced engineering at Columbia University. Three groups have been officially assigned to such duty.

Oregon Starts Move for Large Forest-Road Appropriation

Under the leadership of the Chamber of Commerce of Portland, Ore., civic organizations in that state, and other Coast and Rocky Mountain states are launching a campaign to obtain a Government appropriation of $100,000,000 for the construction of highways through forest reserves. A conference of representatives from Oregon, Washington, California, Arizona, New Mexico, Nevada, Idaho, Wyoming, Montana and Colorado will be held with a view to the appointment of about twenty-five business men who will go to Washington, D. C., to work for the appropriation. It has been suggested that allocation of the appropriation be extended over a 10-year period and allotment made to the states on the same basis as now obtains in the construction of roads through forest reserves.

West Virginia Boosts for Better Roads With Film Drama

"The Road Ahead for West Virginia" is the title of a two-reel motion picture which is being used in West Virginia to promote the adoption of the proposed constitutional amendment authorizing the State legislature to construct 4,500 miles of hard surface highway. James W. Brooks, editorial director of the Highway Industries Association of Washington, D. C., and author and director of the West Virginia film production, spent considerable time in getting his "cast" together and in selecting locations for filming the scenes. The film was made with the idea of not only providing the general public with an idea of what improvements are necessary in West Virginia roads, but also in acquainting it with the life along the roads. The author and director of the production asserts that "the camera has been set on facts and nothing but facts." A circuit rider, a country doctor and undergraduate co-ed from the state university lend local color and animation.

Appalachian Good Roads Association To Meet

Uniform state laws regulating the speed of motor vehicles and the loads placed upon them, together with a reciprocal relationship between the various states in reference to the use of vehicles; the urgent necessity of an interstate system of hard surface highways; and other questions will be among matters for discussion at the Asheville session of the Appalachian Good Roads Association to be held Feb. 26-28. The governors of each of the eleven states comprising this association—Maryland, Virginia, West Virginia, Kentucky, North and South Carolina, Georgia, Florida, Alabama, Tennessee and Arkansas—have been requested to name delegates at large. Besides these, the chambers of commerce, boards of trade, good roads and automobile associations in the various states have also been requested to send representatives.

Would Build Railroad Connecting Amazon and West Coast

The Chilean Congress has authorized the government to contract with a Chilean-Ecuadorean syndicate for the construction of a railroad to extend eastward from Porto Bolivar, Ecuador, into Brazil, giving a Pacific outlet to hitherto inaccessible territory. It is proposed to extend the line over 500 miles to Porto Para on the Amazon River, at an estimated cost of about $30,000,000.

A. A. E. Membership Drive Nets 6,500

The results of the membership drive held during December by the American Association of Engineers finally have been tabulated. Buffalo Chapter won first prize for chapters having a membership of more than 100 with an increase of 318 per cent. For the chapter or club having less than 100 members at the close of the drive the Ogden (Utah) Club won first place with an increase of 209 per cent. The three members of the association obtaining the highest number of individual subscriptions were F. P. Obee of Toledo, Ohio; J. W. Shera of Chicago and Professor Samuel M. P. Dolan of the Oregon State College. They turned in 131, 100 and 66 membership applications respectively.

The chapters which followed Buffalo were Lincoln with 310 per cent, University of Nebraska with 302 per cent and Toledo with 194 per cent. The largest number of applicants per chaper obtained during the drive was 474, obtained by the Chicago Chapter. Of this number 100 were obtained by one man. The second largest chapter in point of number of applications was the Oregon Chapter with 353. The number obtained by the Buffalo Chapter was 242. The Lincoln Chapter and the University of Nebraska Chapter are located in the same city, and had they been consolidated would have won first place.

The membership of the A. A. E. at the close of business on Dec. 31 was 10,423, more than 6,500 applications for membership having been received during the month of December.

Civil Service Examinations

New Jersey. Deputy chief engineer, Department of Streets and Public Improvements, $6,000 per year, Jan. 28. File applications with State Civil Service Commission at Trenton.

United States

For United States civil service examination, listed below, apply to the United States Civil Service Commission, Washington, D. C., or to any local office of the commission, for form 1312.

Chief of Road Survey Party, $1,800 to $2,100 per year. File application before Feb. 10, 1920.

Transitman for road survey, $1,200 to $1,800 per year. File application before Feb. 10, 1920.

Highway draftsman, $1,200 to $1,800 per year. File application before Feb. 10, 1920.

Topographic and subsurface draftsman, Grade 1, $5.20 per day; Grade 2, $6 to $7.20 per day. File application before Jan. 27, 1920.

Ceramic assistant, to fill a vacancy at the Ceramic Experiment Station in the Bureau of Mines, Columbus, Ohio, $1,200 to $1,800 per year, and to fill vacancies in positions requiring similar qualifications. File application before Feb. 10, 1920.

Canada

The Civil Service Commission of Canada will receive applications from residents of Canada, qualified to fill the following positions:

Shipyard superintendent, Sorel, P. Q., salary $3,000.

Foresters, salary $1,680.

Junior engineers, initial salary $1,680.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

BRIDGE BUILDERS' & STRUCTURAL SOCIETY, 50 Church St., New York City; Jan. 16, New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS, 29 W. 39th St., New York City; Jan. 21-22, New York City.

ENGINEERING INSTITUTE OF CANADA; General Secretary, Fraser S. Keith, 176 Mansfield St., Montreal; Jan. 27-29, Montreal.

NATIONAL HIGHWAY TRAFFIC ASSOCIATION, 247 W. 54th St., New York City; Jan. 29, Chicago.

AMERICAN ROAD BUILDERS' ASSOCIATION, 150 Nassau St., New York City; Feb. 9-13, Louisville, Ky.

AMERICAN WOOD-PRESERVERS' ASSOCIATION; Secretary-Treasurer, F. J. Angier, Mt. Royal Station, Baltimore; Feb. 10-12, Chicago.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA; 111 W. Washington St., Chicago; Feb. 18-19, Chicago.

AMERICAN CONCRETE PIPE ASSOCIATION; 210 South La Salle St., Chicago; Feb. 20-21, Chicago.

AMERICAN RAILWAY ENGINEERING ASSOCIATION; 1426 Manhattan Bldg., Chicago; March 16-18, Chicago.

The Western Society of Engineers, Jan. 5, was addressed by Charles Piez, president of the Link Belt Co. on "The Tentative Report of the President's Industrial Commission." The annual dinner of the society will be held Jan. 23. The formation of several new sections—gas, telephone, industrial and railroad—necessitates holding meetings twice a week. A. J. Hammond will speak at an early date before the railroad section on "The Chicago Union Station." Duff A. Abrams, Jan. 12, spoke on "Experimental Studies in Concrete Design at Lewis Institute" before the bridge and structural section. For 1920 this section elected A. W. Dilling, chairman; J. E. Love, vice-chairman, and H. H. Hadsall, director. The society will be addressed at a meeting in February by Herbert C. Hoover, head of the relief commission for Europe and vice-chairman of President Wilson's industrial commission. At that meeting the Washington Award, founded by John W. Alvord of Chicago, will be presented to Mr. Hoover for "pre-eminent services in promoting the public welfare as chairman of the commission for relief of Belgium and as food administrator of the United States." The award is made by a commission representing the Western Society of Engineers and the four national societies of civil, mechanical, mining and electrical engineers.

The Florida Engineering Society will hold its annual meeting Feb. 16 and 17 in Tampa. J. R. Benton of Gainesville is secretary.

The National Drainage Congress will hold a meeting at the Harrington Hotel, Washington, D. C., Jan. 23 and 24, at which time a statement will be prepared concerning its policy in regard to private development and Federal aid. Edmund T. Perkins, Chicago, is president.

Baltimore Chapter, American Association of Engineers, has elected the following officers: J. Harry Gross, president; S. P. J. Patenall, first vice-president; J. H. Adams, second vice-president; Milton J. Ruark, treasurer; Arthur D. Ihlang, secretary. The chapter is growing rapidly and now has about 500 members.

The Chicago Chapter of the American Association of Engineers, Jan. 2, elected the following officers for 1920: President, W. J. H. Strong; vice-presidents, C. L. Currier, W. H. Dean, A. M. Cornell and T. A. Dungan; secretary, J. G. Hoban; treasurer, L. D. Lea. Papers recently presented to the chapter are "Stabilizing the Dollar," by Prof. Wilson, University of Illinois, and "Basis of Appeal for Increased Compensation," by W. E. Vogelback.

The Cleveland Chapter of the American Association of Engineers at its last regular monthly meeting voted to indorse, and to urge other engineering societies in Ohio to indorse, the bill recently introduced into the State Legislature, removing the limitation from the number and salary of map draftsmen in the County Surveyor's map room. The present legislation, passed in 1890, and unrevised since that time according to County Surveyor Stinchcomb of Cuyahoga County, Ohio, provides for not more than four draftsmen at a maximum salary of $1,500 per man. Increased volume of work necessitates fifteen men in Cuyahoga County at the present time. These men are actually

at work, many of them illegally, it is believed. The majority of them are said to be receiving more than $1,500 per year, also illegally but unavoidably, due to the impossibility of securing competent men at the old figure. The bill if passed will affect the five counties in Ohio which maintain drafting rooms.

The **Butte (Mont.) Chapter of the** A. A. E. is advocating the merging of all engineering societies of Butte "for the benefit, the enlightenment and the progress of each organization, especially in dealing with state questions," according to a recent statement issued at its headquarters.

The Casper Club of the American Association of Engineers met Dec. 28 and elected the following officers: N. P. Nelson, assistant engineer, Burlington Ry., president and H. F. Johnson, resident engineer State Highway Commission, secretary.

The Engineers' Club of Cincinnati recently elected F. W. Willey of the Willey-Wray Electric Co. president; F. R. Healy, superintendent of the Union Gas & Electric Co. vice-president, and E. A. Gast, secretary and treasurer. The following were elected directors: George W. Galbraith, E. A. Muller, Frank Raschig, A. F. Shepard, G. M. Braume, Ward Baldwin and William P. Fosdick.

The Richmond Chapter of the American Association of Engineers recently effected a permanent organization with the following officers: President, J. C. Dickerman; vice-president, Arthur Scrivenor; secretary, A. S. Holway; treasurer, J. Henley Walker.

PERSONAL NOTES

ASSISTANT PROFESSOR J. B. KOMMERS of the Department of Mechanics at the University of Wisconsin, has been appointed special research associate professor of engineering materials at the University of Illinois Engineering Experiment Station. Professor Kommers has a leave of absence from the University of Wisconsin to take immediate charge of the testing work of the Joint Investigation of the Fatigue of Metals, now in progress at the University of Illinois, under the auspices of the National Research Council, Engineering Foundation, and University of Illinois Experiment Station.

FRANCIS H. M. RILEY, formerly with Vaughn & Meyer, consulting engineers, Milwaukee, has become Wisconsin representative for the Vulcan Soot Cleaner Co., Vulcan Fuel Economy Co., and the Green Engineering Co.

H. T. CORY, consulting engineer of the U. S. Reclamation Service, leaves for Egypt Jan. 20, where he will serve as one of three members of an international commission which has been selected to pass on plans for irrigation work on the Nile River.

MARCELLUS P. LEE, who recently was discharged as captain, Engineers, U. S. A., has become connected with Clarkson & Gaines, architects, Fort Worth, Texas, as superintendent of construction and engineer in charge of their Amarillo, Texas, office.

LIEUT. H. J. LALONDE, recently discharged from the 71st Field Artillery, has accepted a position with the St. Louis office of the Portland Cement Association.

BURR M. STARK, Assoc. M. Am. Soc. C. E., formerly associated with Morrell Vrooman, consulting engineer of Gloversville, N. Y., has been appointed Commissioner of Public Works of Amsterdam, N. Y., with the duties of City Engineer, as this position has been abolished and the office consolidated with that of Commissioner. Mr. Stark has engaged in municipal engineering during the past eight years.

JOHN A. STEVENS, vice-president of the American Society of Mechanical Engineers and consulting engineer in power-plant design and construction, has opened an office in Fall River, Mass., to handle business in the southern New England district. Carl J. Sittinger will be in charge of the office.

ROY N. STEWART, county engineer of Richland Co., Mont., has been appointed city manager of Scobey, Mont.

WALTER E. DOOLITTLE has left the Idaho State Highway Department to accept a position with the county engineer at Colfax, Wash.

A. W. MAHON has tendered his resignation as state engineer of Montana and member of the Montana State Highway Commission in order to enter private practice.

A. D. BUTLER has been reappointed city engineer of Spokane, Wash., and LEONARD FUNK is continued as Commissioner of Public Works for that city.

J. F. ELLINGTON has resigned as chief engineer of Joseph E. Nelson & Sons to organize, with O. G. MILLER, formerly in the general manager's office of the Illinois Central R.R., the firm of Ellington & Miller, Inc., general contractors specializing in railway buildings and terminals. The offices of the new firm are at 417 S. Dearborn St., Chicago, Ill.

L. R. OWEN, senior member of Owen & Plummer, Inc., engineers, Johnstown, Pa., is now borough engineer of Brownstown Borough, Cambria County.

A. C. LAGERWALL, resident engineer of the Douglas Co. Federal-aid roads, with C. B. HOLMES and N. F. STRACHAN, has opened an engineering office at Lawrence, Kan. Mr. Lagerwall was formerly connected with the Portland Cement Association. Mr. Strachan is Associate Professor of civil engineering at the University of Kansas. Mr. Holmes had formerly served as assistant under Mr. Lagerwall in county road work.

N. H. DAVIS, head of the department of civil engineering at the University of Florida, has been retained by the commissioners of Smith County, Tenn., as chief engineer in charge of road construction.

CHESTER R. ANTHONY, Altoona, has been appointed engineer of the Borough of Roaring Spring, Blair County.

O. P. THOMAS, Johnstown, Pa., has been re-elected borough engineer of Westmont Borough, Cambria County.

H. B. KIRKLAND, captain in the construction division of the Army until Jan. 1, has resumed his duties as president of the Concrete Mixing & Placing Co., with offices in the First National Bank Building, Chicago. Captain Kirkland was in charge of water-works and sewer construction and of purchases for the Delaware Ordnance Depot at Fredericktown, N. J. Recently he has been engineer officer at the Chicago Storage Depot transforming a Symington arms plant into a storage warehouse.

ALFRED D. LUDLOW, formerly connected with the Engineering Department of Kansas City, sewer section, is now engaged in consulting work in that city.

FRANK R. LANAGAN has been reappointed city engineer of Albany during the second term of the Mayor. Other reappointments in the Albany city administration are J. Sheldon Frost, Commissioner of Public Safety, and Wallace Greenalch, Commissioner of Public Works.

WILLIAM W. COX, for ten years connected with the Michigan State Highway Department, has been appointed Road Manager of St. Clair Co., Michigan, to carry out an extensive road building program in that county.

FLOYD H. FISH, recently employed in the Research Department of the Great Western Sugar Co., Denver, Colorado, has been appointed special research test assistant at the University of Illinois Engineering Experiment Station. He will be one of the test party engaged in the investigation of fatigue of metals at that institution.

OBITUARY

GEORGE WESTON, engineer of the Philadelphia Rapid Transit Co. and for some years assistant chief engineer of the Board of Supervising

Engineers in control of the Chicago tractor system, died in Philadelphia, Jan. 7. He was born at Kalamazoo, Mich., Jan. 20, 1861, and began his engineering career in 1880 as a rodman on the Missouri, Kansas & Texas R.R. He was connected with the construction of some of the early cable railways in Chicago and later carried out their conversion to electric traction, while in later years he was occupied largely in street railway improvement and valuation work. He was appointed to the Board of Supervising Engineers in 1907 and resigned in January, 1919, to go to the Philadelphia company.

EZRA FRED WOOD, consulting engineer with the International Nickel Co., died suddenly on Jan. 5 in the subway, at the age of sixty-one. He was one of the organizers of the company in 1902, coming to it from the Carnegie Steel Co., with which he had been connected for twenty years. Until two years ago he was vice-president. He was graduated from the University of Michigan and was a recognized authority on metallurgy.

Truck and Trailer Do Work of 40-Foot Railroad Car

Inability of the Westcott Motor Co., Springfield, Ohio, to obtain railroad cars to ship automobile bodies from Muncie, Ind., to its Springfield warehouses, led the company to employ the J. S. Wagner Transfer & Storage Co., Springfield, to haul bodies by auto truck. With truck and Troy trailers the transfer company hauled 21 of these bodies at a trip, the 200-mile round trip being made in 20 hours. The 21 light-6 touring car bodies—equal to the number that can be loaded into a 40-ft. railroad car—average about 500 lb. apiece, making a total load of only 10,500 lb. for both truck and trailer. The trailer is equipped with special racks, has a 22-ft. chassis and is of three-ton capacity. Protection from rough weather is offered the touring-car bodies by a large canvas envelope that fits closely over them.

BUSINESS NOTES

THE CANADIAN ENGINEERING AGENCY, INC., has been appointed and the Pearson Engineering Corporation has ceased to act as purchasing agents for the following companies: Ebro Irrigation & Power Co., Ltd.; Cataluna Railways, Ltd., and Allied Co.; Mexico Tramways Co.; Mexican Light & Power Co., Ltd., and Allied Co.; Rio de Janeiro Tramway, Light & Power Co., Ltd.; Rio de Janeiro and Sao Paulo Telephone Co.; Societe Anonyme du Gaz de Rio de Janeiro and Allied Co.; Sao Paulo Tramway, Light & Power Co., Ltd.; Sao Paulo Electric Co., Ltd., and Allied Companies. Louis J. Hirt is the consulting engineer and Walter P. Plummer is in charge of the purchasing department.

THE WICKWIRE STEEL CO., Buffalo, a $5,000,000 corporation, has been acquired by the Clinton-Wright Wire Co., a $16,000,000 Massachusetts corporation, after negotiations extending over a period of several months. The consolidated interests, which will be the second largest steel and wire industry in the world, will be known as the Wickwire-Spencer Steel Corporation, with a capitalization of more than $20,000,000. The principal officers of the corporation will be: president, T. Harry Wickwire, Buffalo; vice-president, Ward A. Wickwire, Buffalo; vice-president and general manager, George M. Thompson, president of the Clinton-Wright Co.

WILLIAM R. CONARD, AND J. STEWART BUZBY, who for a number of years has been actively associated with Mr. Conard as principal assistant, have formed a partnership for the continuation of the business of inspection and tests of materials, with especial relation to water and gas works supplies, and of reports, specifications, designs and general engineering, under the name of Conard & Buzby.

THE SOUTHERN ENGINEERING CO. of New Orleans has changed its name to that of Davidson Bros., with C. P. Davidson and W. H. Davidson remaining as partners in the firm's business of representing machinery and steel concerns.

TRADE PUBLICATIONS

The following companies have issued trade publications:

GUARANTY TRUST COMPANY OF NEW YORK; pamphlet, 4½ x 7 in., 30 pp., entitled "Federal Stamp Taxes on Original Issues of Stocks and Bonds and Transfers of Stocks." The pamphlet describes the stamp tax, and its application to and computation for various forms of paper issues.

F. C. AUSTIN CO., INC., Chicago; 16-sheet folder, 10 x 10½ in., presenting graphic illustrations of the Austin tube and drum mixers; also booklet, 7 x 10 in., 84 pp., describing and illustrating the Austin tube mixer, as adapted for various classes of work.

THE AUTOCAR CO., Ardmore, Pa.; 6 x 8 in. pamphlet of 7 pp. containing seven illustrations of Autocar equipment and a list of several hundred Autocar owners, to whom the text invites reference.

THE DAVIS-BOURNONVILLE CO., Jersey City, N. J.; bulletin, 8½ x 11 in., eight pages, illustrated, on "Directions for Installation and Operation of Davis Acetylene Generators Nos. 25, 50 and 100," prepared especially for users of the equipment.

THE AMERICAN CEMENT MACHINE CO., INC., Keokuk, Iowa; catalog No. 920, 8½ x 11 in., 63 pages, illustrated, describing, "'Boss' Labor-Saving Construction Machinery." It contains descriptions of various forms of contractors' concrete machinery and equipment, with illustrations of their use.

AUTOMOBILE BODIES HAULED BY TRUCK